Skyways

Flight Operations
•
Engineering
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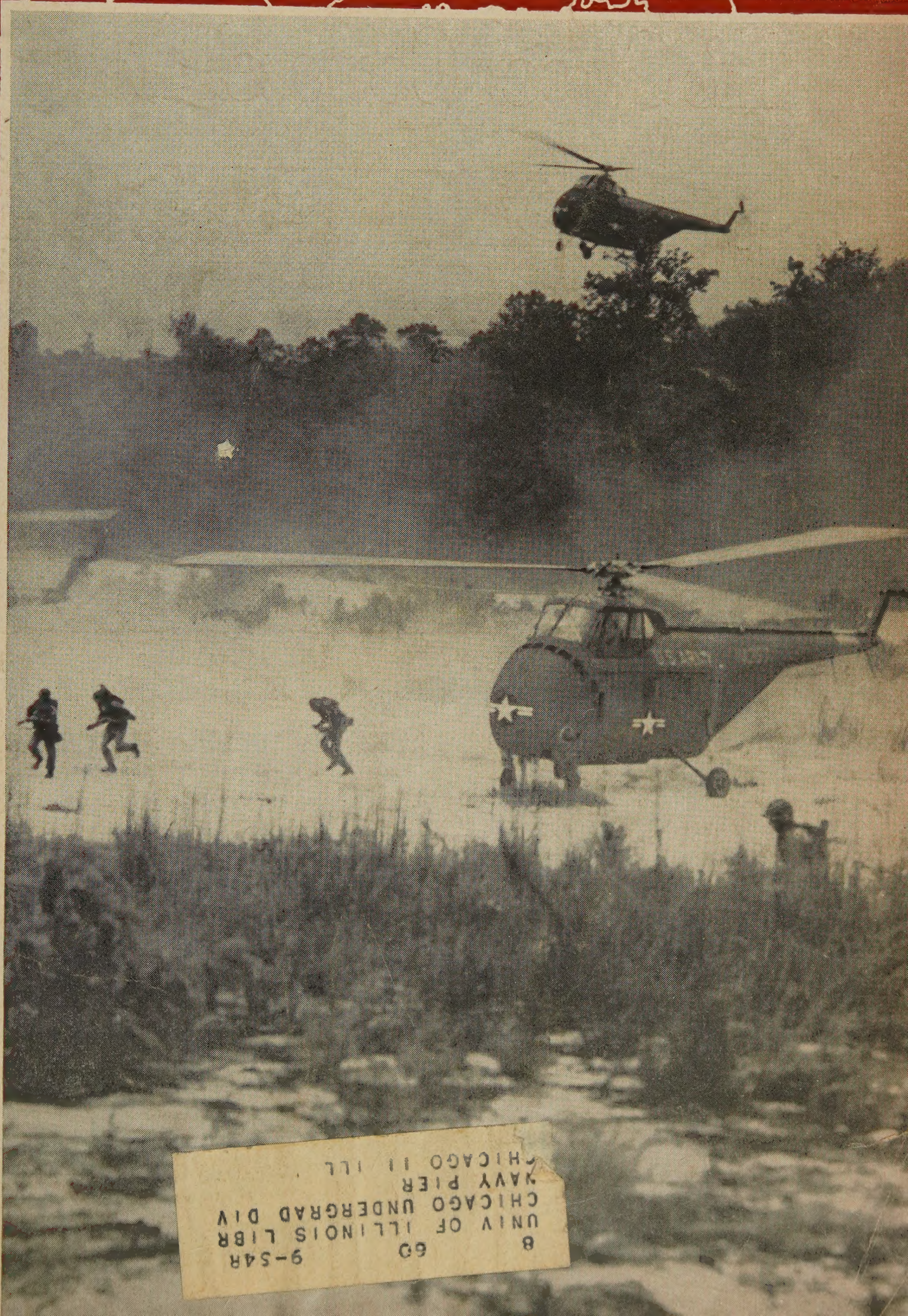
Management



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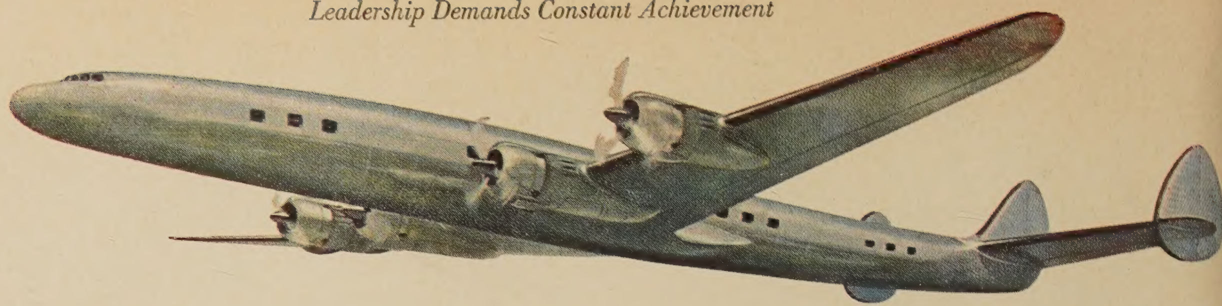
Leadership Demands Constant Achievement



With World Airlines...

It's Super Constellation 4 to 1

ORDERED BY 4 TIMES AS MANY AIRLINES AS NEAREST U.S. TYPE

...TWICE AS MANY AS FOREIGN JET TYPES

18 AIRLINES, serving every continent in the world, have already ordered Lockheed Super Constellations:

AIR FRANCE ... AIR INDIA ... AVIANCA OF COLOMBIA ... BRAATHENS OF NORWAY ... EASTERN AIR LINES ... IBERIA OF SPAIN ... KLM ROYAL DUTCH AIRLINES ... LAV VENEZUELA ... MEXICO ... NORTHWEST ORIENT AIRLINES ... PAKISTAN INTERNATIONAL ... QANTAS OF AUSTRALIA ... SEABOARD & WESTERN ... THAI AIRWAYS ... TRANS-CANADA ... TWA-TRANS WORLD AIRLINES ... VARIG OF BRAZIL ... WEST GERMANY.

NEW SPEED—*Hours* quicker to destination. *On time* departures, and *on time* arrivals!

NEW RANGE—Non-stop range on longer routes than ever before. Plenty of margin to go around and over weather.

NEW POWER—13,000 horsepower! Latest type turbo-compound Wright engines. Power to spare means *better performance, better dependability.*

NEW COMFORT—5 separate cabins to roam through. Interior design by Henry Dreyfuss for people who *enjoy* travel.

NEW LUXURY—Spacious lounge and glamorous decor *unlike any other airplane* in the world.

INSIST ON SUPER CONSTELLATION! IT COSTS NO MORE TO FLY THE BEST!

Lockheed Super Constellation

LOCKHEED AIRCRAFT CORP., BURBANK, CALIF., AND MARIETTA, GEORGIA

Look to Lockheed for Leadership

Again Goodyear comes to the fore—proves best in grueling tests!

FIRST choice of Douglas for the great new DC-7, Goodyear Wheels and Single-Disc Type Brakes are 100% standard equipment on the fastest nonstop, coast-to-coast commercial airliner.

Grueling field tests conducted by the C.A.A. and Douglas engineers proved the remarkable dependability of Goodyear-built main wheels, brakes and nose wheels for the new DC-7 — landing *full gross loads* time after time *well within* certified field lengths.

GOODYEAR AVIATION PRODUCTS

Flexibility of the Goodyear Brake design was responsible for the achievement of the high-torque design necessary to meet and *exceed* the Douglas field-test requirements.

So now the DC-7 joins the ranks of the nation's foremost commercial aircraft which rely on the time-proved dependability of Goodyear wheels and brakes—now flying on Consolidated 240's and 340's, the Martin 202, 404 and Lockheed's Constellations, as well as on the great forerunners of the new DC-7 — the DC-4's, 6's and 6B's. Goodyear, Aviation Products Division, Akron 16, Ohio or Los Angeles 54, Calif.

FACILITIES + ABILITIES = EXTRA *plus* IN PERFORMANCE

think you'll like "THE GREATEST STORY EVER TOLD"—every Sunday—ABC Radio Network—THE GOODYEAR TELEVISION PLAYHOUSE—every other Sunday—NBC TV Network

...AT LOWER COST
COMPLETE NEW VHF

Clear, dependable 2-way voice communications for ground-to-air... or point-to-point service. Check these Bendix specs against any other complete ground station you can find:

RECEIVER SPECIFICATIONS

FREQUENCY RANGE: 118 mc to 136 mc (by changing one fixed capacitor frequency range can be increased to 152 mc.)

SENSITIVITY: Less than 2.5 hard microvolts is required for 6db S +N/N ratio with 30% modulation at 100 cps.

FREQUENCY STABILITY: 0.005% from -25°C to +55°C.

BANDWIDTH: ±20 kc at -6db attentuation
±45 kc at -100db attentuation

SPURIOUS RESPONSE: Greater than -90db.

AUDIO RESPONSE: Less than 3db variation from 300 to 3500 cps.

AVC CHARACTERISTICS: 3db variation with input varied from 5 to 100,000 microvolts for one watt output.

NOISE LIMITER: Audio output variation not more than 2db from 70% modulation to 100% modulation.

SQUELCH: Range 0 to 50 microvolts. On-off differential at 2 microvolts input level, 0.3 microvolts.

TEMPERATURE RANGE: -25°C to +55°C.

HUMIDITY RANGE: 0 to 95% at 50°C.

PRIMARY POWER: 117 volts, 50/60-cycles ac, approximately 85 volt-amperes.

AUDIO OUTPUT IMPEDANCE: 600-150-4 ohms.

R-F INPUT IMPEDANCE: 52-ohm coaxial with maximum standing wave ratio of 2 to 1 from 118 to 136 mc.

TRANSMITTER SPECIFICATIONS

FREQUENCY RANGE: 108 mc to 136 mc.

POWER OUTPUT: 50 watts unmodulated.

EMISSION: A3 (A.M. Telephony)

OUTPUT CIRCUIT: To feed 52 ohm coaxial cable. Complete with antenna co-ax relay (send/rec.) installed.

MODULATION CAPABILITY: 95% at 1000 cps.

NUMBER OF CHANNELS: One. Can add crystal relay to give two channel operation. Second channel less than 800 kc away.

FREQUENCY STABILITY: 0.005% from -25°C to +55°C.

AUDIO INPUT: 500 ohm center tap or carbon mic. Minimum level approximately -15db into 500-ohm input.

AUDIO RESPONSE: Within 6db from 300 to 4000 cycles.

DISTORTION: 10% maximum at 95% modulation level (1000 cycles.)

NOISE LEVEL: 40db below 95% modulation with 60-cycle supply.

INPUT POWER: 117 volts, 50/60-cycles ac.
STANDBY: 80 watts.
FULL OUTPUT (95% modulation): 380 watts.

TEMPERATURE RANGE: With 866 mercury tubes 20°C to 55°C.
With 3B25 gas tubes -25°C to +55°C.

Write, wire or phone W. E. Cleaves, General Sales Manager, Bendix Radio Communications, Baltimore 4, Maryland, or contact the Bendix Sales office nearest you.

Bendix Radio

DIVISION OF BENDIX AVIATION CORPORATION • BALTIMORE 4, MARYLAND

Export Sales: Bendix International Division, 205 E. 42nd St., New York 17, N.Y., U.S.A.

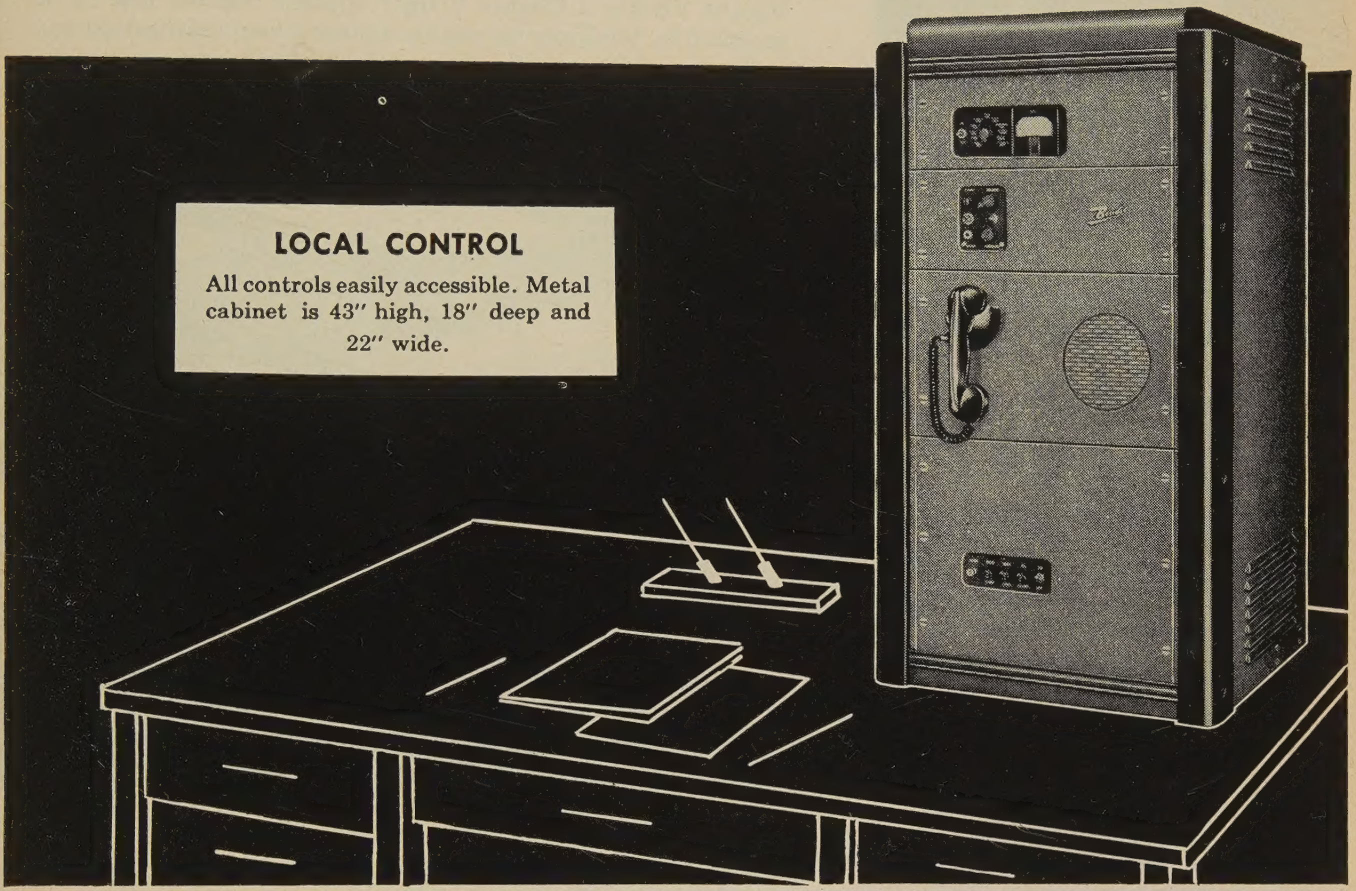
West Coast Sales: 10500 Magnolia Blvd. North Hollywood, California

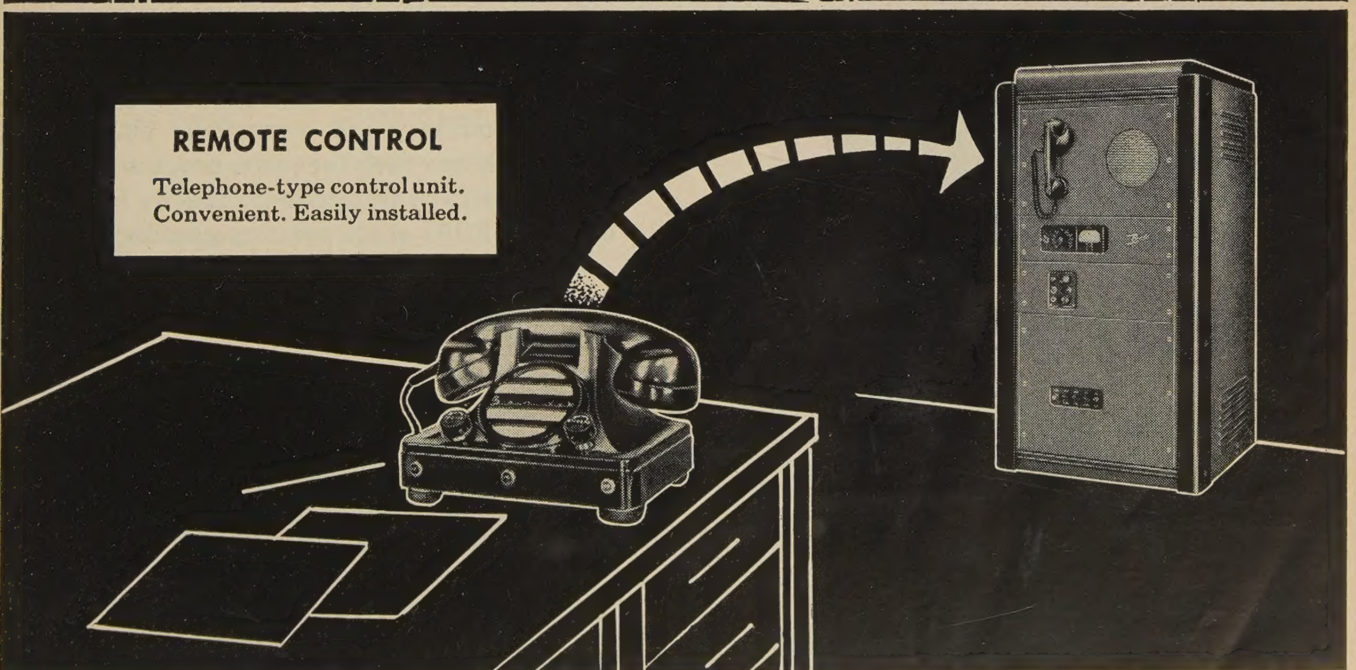
Southwest Sales: 3300 Love Field Drive, Dallas, Texas

*Reg. U. S. Pat. Off.

Canadian Distributor: Aviation Electric, Ltd., 200 Laurentian Blvd., Montreal, Quebec

BENDIX RADIO OFFERS GROUND STATIONS!





LOCAL CONTROL

All controls easily accessible. Metal cabinet is 43" high, 18" deep and 22" wide.

REMOTE CONTROL

Telephone-type control unit. Convenient. Easily installed.

Skyways

Flight Operations • Engineering • Management

Cover: Army H-19 copters on maneuvers

FOUNDED BY J. FRED HENRY, 1942

EDITOR & PUBLISHER Mrs. J. Fred Henry	MANAGING EDITOR D. N. Ahnstrom	EDITORIAL DIRECTOR Franklin D. Walker
ART DIRECTOR P. Nowell Yamron	PRODUCTION MGR. Stanley M. Cook	READER SERVICE MGR. Jack Galin

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MEMBER AUDIT BUREAU OF CIRCULATIONS

VOLUME 13, NUMBER 2

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now hear this . . .

PERSONNEL

Dr. L. A. Slotemaker, Executive Vice President of Foreign Relations for KLM, has been named Chairman of the Air Transport Committee of the International Chamber of Commerce.

Preston R. Bassett, president of Sperry Gyroscope Co., and **Ralph S. Damon,** president of Trans World Airlines, were appointed to NACA membership.

Clarence Francis was elected to the board of directors of Bendix Aviation Corporation. He is presently a director of the Federal Reserve Bank of New York and chairman of the Citizens' Committee for the Hoover Report.

Harold W. Sweatt, president of Minneapolis-Honeywell Regulator Company, recently was elected board chairman.

John R. Alison has been elected administrative vice president of Northrop.

Edmund L. Ryder recently was named assistant manager of AiResearch Aviation Service Company.

Raymond F. Johnson is now an Application Engineer at the El Segundo, California, office of Vickers, Inc. His prime responsibility is the Boeing Aircraft account, including Seattle and Wichita.

O. E. Anderson has been named to the technical staff of Continental-Diamond Fibre Company.

C. E. Tremblay is now Manager of the Aviation Department of the Canadian Marconi Company.

Marvin B. Ruffin has been appointed Director of Customer Relations of Summers Gyroscope Company.

Matthew J. Betley was appointed Vice President and General Manager of Aeroquip Corporation.

W. C. O'Connell has been appointed General Manager of the General Electric Company's Accessory Turbine Dept., and **Harold T. Hokanson,** former manager of project objectives for the Aviation Engineering Section of GE's Aviation Division, has been named a project manager in the Small Aircraft Engine Department of the Aircraft Gas Turbine Div.

Edward G. Conway has been named works manager for The Kaman Aircraft Corporation.

Tom Kennett recently was appointed to the Export Dept. of Cessna Aircraft Company.

COMPANIES

Andrew Alford Consulting Engineers, Boston, Mass., has been elected to membership in the Radio Technical Commission for Aeronautics.

Fairchild Engine and Airplane's Board of Directors has approved final plans to purchase the assets of the Speed Control Corp., of Wickcliffe, Ohio, a technical organization engaged in the development and production of devices which provide speed control of power output. Under Fairchild, Speed Control will operate as a separate division at its present location.

Cessna Aircraft has received a letter contract for an additional 100 Cessna L-19 military observation aircraft.

Collins Radio Company has organized a wholly owned Canadian subsidiary, Collins Radio Company of Canada, Ltd. Offices are located in Ottawa, Ontario.

Central-Lamson Corporation has been organized to build production models of the specially designed "Air Tractor," a new dusting and spraying airplane. Prime organizers of the new $250,000 firm are Central Aircraft, Inc., of Yakima, Washington, and Lamson Aircraft Co., of Seattle, consulting and design engineers.

AWARDS

Dr. Leslie A. Bryan, Director of the Institute of Aviation, University of Illinois, is this year's (1953) recipient of the Frank G. Brewer Trophy of the National Aeronautic Association.

The Honorable Carl Hinshaw, Republican Member of the House of Representatives from the 20th District of California, was awarded the 1953 Wright Brothers Memorial Trophy.

Charles Augustus Lindbergh has been named the recipient of the Daniel Guggenheim Award for 1953 for "pioneering achievements in flight and air navigation." Presentation of the award was by Harry Guggenheim at the Honors Night Dinner of the Institute of Aeronautical Sciences.

AERO CALENDER

Jan. 25—IAS Honors Night Dinner, Astor Hotel, New York.

Jan. 25-29—Twenty-second Annual IAS meeting, Astor Hotel, New York.

Jan. 25-28—Plant Maintenance & Engineering Conference and Show. Hotel Conrad Hilton, Chicago.

Feb. 3-5—Society of Plastics Industry. Edgewater Beach Hotel, Chicago.

Feb. 4—Instrument Society of America, Ninth Annual regional conference. Hotel Statler, New York.

Feb. 21-23—Third Annual Texas Agricultural Aviation Conference, Texas A&M College, College Station, Texas.

Feb. 27-28—Eighth Annual Pacific Coast Mid-Winter Soaring Meet, Torrey Pines Glider Port, San Diego, Calif.

Mar. 22-25—Institute of Radio Engineers National Convention, Hotel Waldorf Astoria, New York.

Apr. 5-6—Society of Plastics Industry, Inc. (Canada), 12th Annual conference. Mount Royal Hotel, Montreal.

Apr. 29-30—American Society of Tool Engineers, Convention Center, Philadelphia.

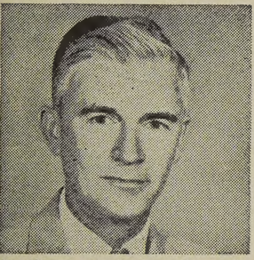
May 5-7—Third International Aviation Trade Show. 71st Regiment Armory, New York.

AERO *Commander* NATION-WIDE SALES and SERVICE ORGANIZATION

IN LOS ANGELES IT'S AIRESEARCH

An unbeatable combination of veteran leadership and unlimited facilities has made AiResearch Aviation Service Company headquarters for executive and private aircraft on the west coast. Under the able direction of general manager Jack O'Brien and sales manager Fred Smith, AiResearch is performing every aviation service from the simplest repair to major conversion of the world's largest aircraft.

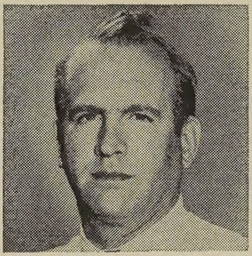
Fred Smith, Sales Manager, AiResearch Aviation Service Co., 5907 W. Imperial Highway, Los Angeles 45, California.



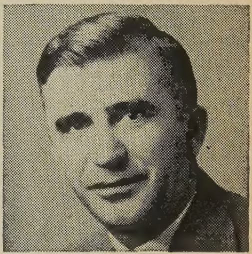
H Warren Holladay, Stonnell and Holladay, Easton Municipal Airport, Easton, Md.

Don Pennington, Carolina Aero Company, Municipal Airport, Asheville, North Carolina.

George Harte, Harte Flying Service Inc., Chanute Municipal Airport, Chanute, Kan



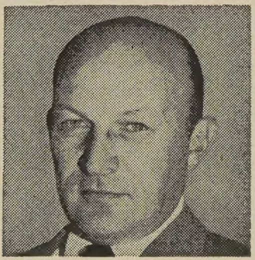
Walter R. Crow, Walter R. Crow, Inc., Municipal Airport, Toledo, Ohio.



B. G. Vandre, Van's Air Service, Municipal Airport, St. Cloud, Minnesota.

C. W. "Wayne" Crussell, Southern Aero, Inc., Municipal Airport, Atlanta, Georgia.

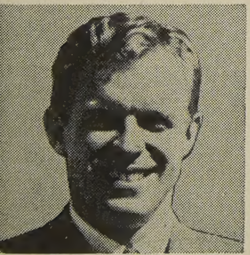
Cheston M 'Chet' Newhall, The Babb Co (Canada) Ltd., Montreal Airport, Dorval, P.Q



Art Meurer, Arthur Meurer Co., Inc., LaGuardia Field, New York, N. Y.

O. B. Callan, Sales Manager National Aero Sales Corp., Midway Airport, Chicago, Ill

Don Hood, President, Air Sales & Service, Inc. Weir Cook Municipal Airport, Indianapolis, Indiana.



Peter Graves, Southern Ohio Aviation Company, Inc., Dayton Municipal Airport, Vandalia, Ohio.

T E "Ted" Byron, Aero-Ways, Inc., Municipal Airport, Cleveland, Ohio.

J. K. "Johnny" Hamp, Aero Sales Division, Houston Transportation Co., Municipal Airport, Houston, Texas.

Cy Willock, Sales Manager Downtown Air-Park Inc., 1800 South Western, Oklahoma City, Oklahoma

H. Leibee Wheeler, Buffalo Aeronautical Corporation, Buffalo Municipal Airport, Buffalo, New York.

AERO DESIGN *Commander*

AERO DESIGN AND ENGINEERING COMPANY

TULAKES AIRPORT • OKLAHOMA CITY, OKLAHOMA

DC 7

the latest and greatest Douglas achievement

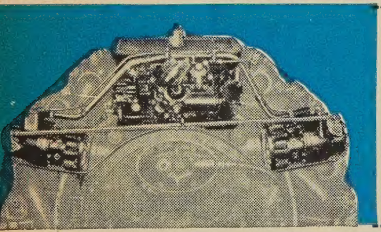
The new DC-7, another in the long list of firsts credited to the Douglas Aircraft Company, sets new standards of passenger comfort and convenience.

Powered with four Wright Turbo-Compound engines and using the Bendix* Direct Injection Fuel System, this new giant of the airways is the fastest of Douglas' long line of great transports.

Every detail of interior trim, every mechanical improvement in this great new plane has been designed to make flying as pleasant as possible.

Over the years the challenge of faster schedules at lower operating costs has been met by Bendix Products through the development of more efficient fuel metering. Problems of landing heavier loads at higher speeds have likewise been solved with efficient, high strength and low weight Bendix brakes, struts and landing gear.

*REG. U. S. PAT. OFF.



BENDIX DIRECT INJECTION FUEL SYSTEM

Lowers maintenance costs • Gives longer engine life • More engine power • Better altitude performance and engine acceleration • Easier starting • Shorter warm-up periods • More payload or more ton-miles per gallon

BENDIX • PRODUCTS DIVISION • SOUTH BEND Bendix AVIATION CORPORATION

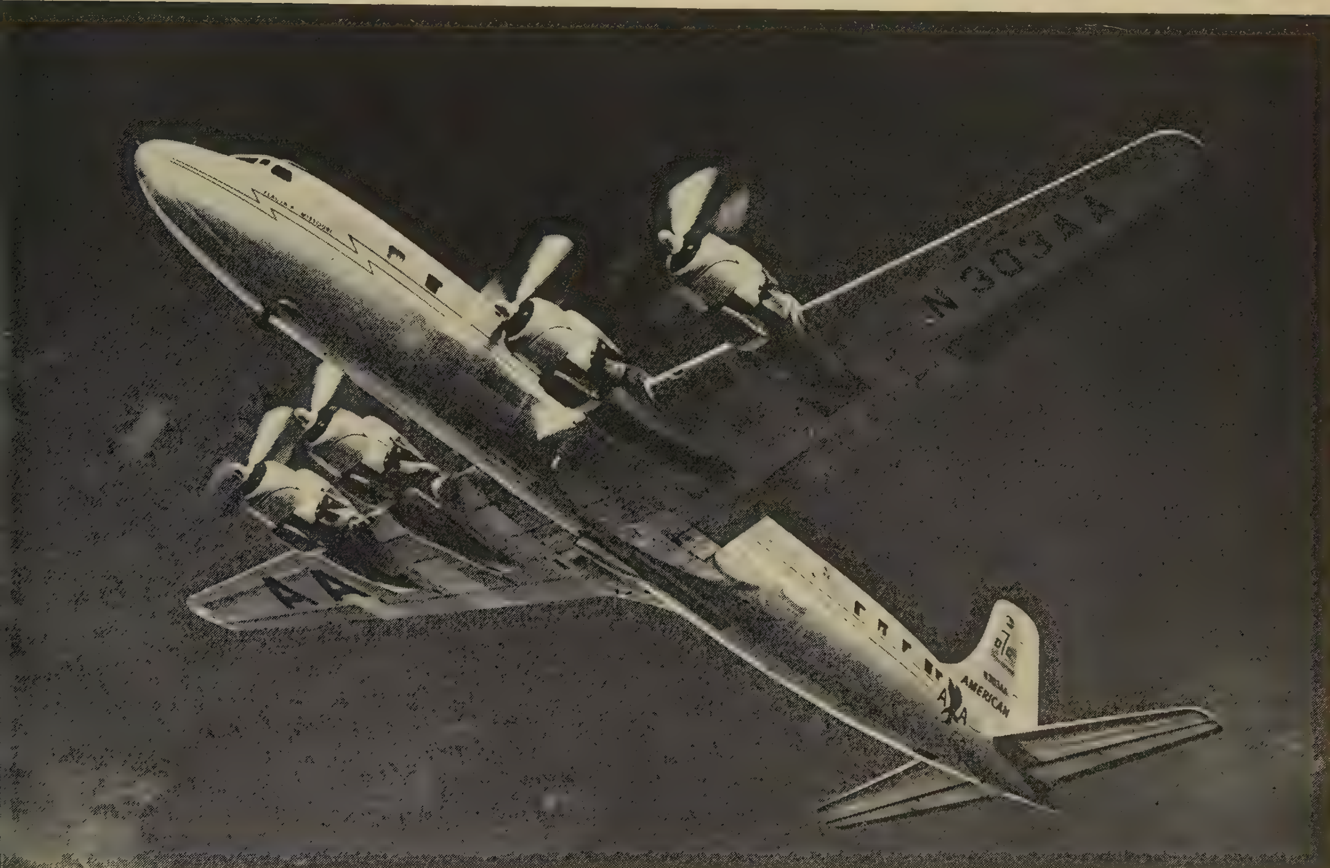
Export Sales: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.

technical evaluation

By Capt. Glenn H. Brink
Chief Engineering Pilot
American Airlines

DOUGLAS DC-7

Excellent performance plus anticipated improvements suggest turbo-compound DC-7 will not be the last of the piston-powered transports



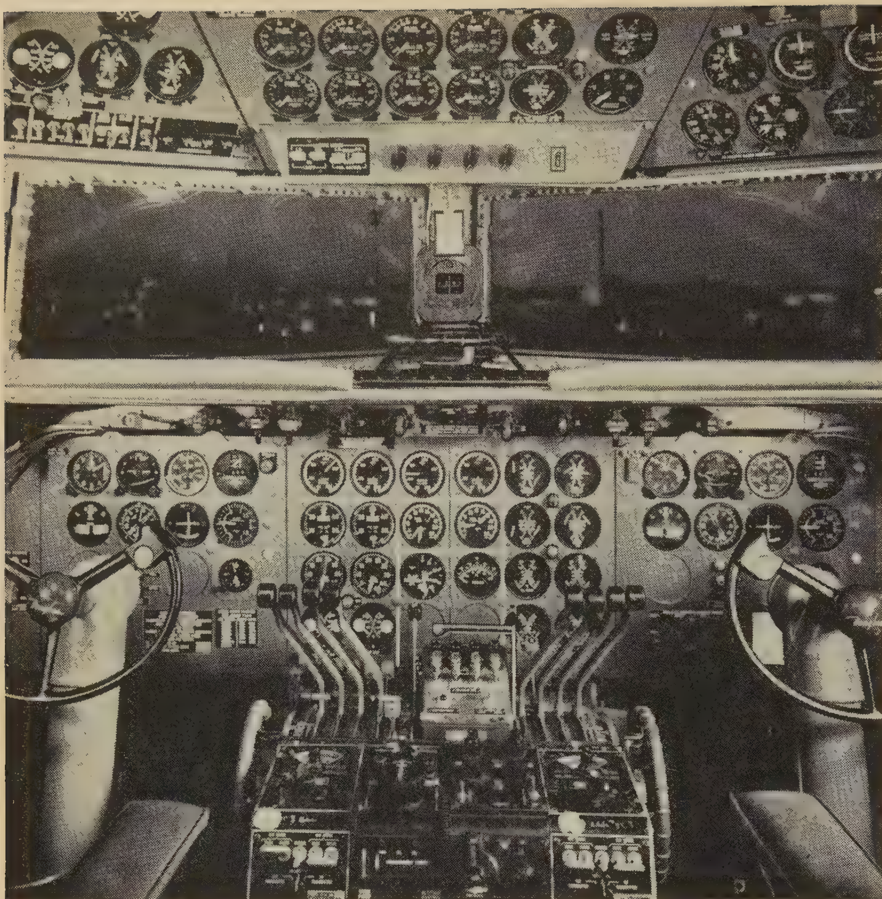
OUGLAS DC-7, *powered by four Wright turbo-compound engines, eats 60 passengers, cruises at 365 mph at 13,000 feet, and has a range of 2,920 miles (transcontinental non-stop version). The DC-7's rate of climb with engine out is impressive (see chart)*

The Douglas Aircraft Company has just introduced its 1954 model airline transport—the DC-7, which is ruly a 1954 model of the well-known DC-6 series air-raft. Its exterior dimensions are almost identical to those f the DC-6B except that the fuselage has been lengthened) inches. This permits adding an additional row of eats and provides better balance. Also, increased power ives an appreciable increase in gross weight and in ruising airspeed.

At the request of American Airlines, the Douglas ompany and American Airlines entered into contract build the DC-7 in December, 1951. The aircraft made s first flight May 18, 1953; was certificated by the AA November 12, 1953; and was placed in commercial service by American Airlines in the first non-stop operation between Los Angeles and New York, in both directions, November 29, 1953. This represents what is believed to be the most rapid development of a new airlines transport yet achieved. Certainly, the entire Douglas organization is to be commended for its fine job.

Prior to CAA certification, American Airlines took delivery of two DC-7's with experimental licenses, for use in maintenance and flight training. Thus, flight and maintenance personnel were well qualified to start scheduled operation soon after the DC-7 was certificated.

Design: The new features of the DC-7 read something like the current advertisements for new 1954 automobiles—"increased power"—"low fuel consumption"—



COCKPIT *arrangement maintains standardization between all American Airlines' DC-6 and -7 type aircraft. New speed brake handle is located on pedestal between the first officer's throttles and the prop control selector box. Both Collins, Bendix radio are used*

"Freon refrigeration cooling system"—"improved power steering"—"power brakes"—"increased capacity electrical system"—etc. Even with these new features, however, the majority of the systems on the DC-7 are identical to the DC-6/6B. We will herein primarily point out improvements and changes that have been made in the familiar DC-6 series aircraft and give our comments based on our use of the DC-7 to date.

Powerplant: The heart of the DC-7, or "muscles" as some prefer, is the Wright Turbo Compound engine. Its 3,250 BHP "dry" take-off rating and its 1,910 BHP maximum cruise power rating combined with the amazingly low specific fuel consumption make possible this new faster airline transport. This engine is the conventional Wright 3350 equipped with fuel injection, two-speed integral superchargers, low tension ignition and manual spark advance, but added are three power exhaust turbines. It is these power recovery turbines that boost "shaft" power some 20% by utilizing the wasted energy in the exhaust system.

A comparison of engine power and fuel consumption is shown in the chart *(Fig. 1)* condensed from a Wright brochure *(page 36)*.

From the chart's figures you can see that this engine with its turbines and propeller might justifiably be called a compounded turboprop engine since some 400 hp is supplied to the propeller by the exhaust turbines. From observations made during American Airlines' Flight Acceptance program, engine take-off power output is easily obtained at the specified manifold pressures. The actual fuel consumption of 500 gallons/hour at maximum cruise power is lower than the manufacturer's guarantees. Critical altitudes for take-off, rated, and cruise power as demonstrated in the airplane are only slightly below the manufacturer's published information.

Propellers: A Hamilton Standard four-bladed 13 ft. 6 in. diameter solid dural propeller is used to absorb the higher engine power. Operationally, this propeller is identical in every respect to the propeller used on the DC-6. However, one major improvement in the design of the prop is the locking mechanism in the propeller hub which mechanically restrains the propeller in the feathered position. This has proven to be effective in preventing rotation of a feathered propeller in flight at extremely high airspeeds.

Although a high-capacity new type governor was originally planned for the DC-7, operational difficulties—caused primarily by the larger overhang moment of this governor and aggravated by engine nose-case vibration—have necessitated temporarily returning to the DC-6 type governor. As a result, feathering and unfeathering, and reversing and unreversing are noticeably slower than on DC-6's using the Hamilton Standard propeller. Pilots easily overcome the slower reversing by more judicious use of the throttles. The slightly slower feathering and unfeathering is of no real concern operationally.

Aircraft: The DC-7 exterior dimensions are identical to the DC-6B expect that a 40-inch spacer has been added just aft of the trailing edge of the wing. This dimension was picked to permit addition of an extra row of seats. It was added aft of the wing to off-set the added weight of the larger, heavier engine and propeller to permit better longitudinal balance. This gives a seating capacity of 60 passengers, still providing the observation lounge in the aft section of the airplane. In addition to passenger seats, there are provisions for the crew of five plus a seat in the cockpit for an observer. All structural components have been generally beefed up for the higher gross weights and higher speeds. Throughout the aircraft structure 24ST and 75ST aluminum is used. Use of titanium for the engine nacelles is an innovation on commercial transports. All control surfaces, as on the DC-6, are metal covered except for the rudder which is fabric covered.

This larger aircraft has naturally resulted in increased operating weights. The empty operating weight of American Airlines aircraft is approximately 70,600 lbs, with a zero fuel and oil weight of 88,350 lbs, giving a payload of approximately 18,000 lbs. Later DC-7's will have a 2,000-lb higher zero fuel and oil weight and a corresponding increase in payload. Maximum landing weight

s 95,000 lbs and will be increased to 7,000 lbs on later aircraft. Maxinum take-off weight is dependent on uel capacity. Those aircraft equipped vith the 4,512-gallon fuel and 46-gallon oil capacity have a maximum ake-off weight of 116,800 lbs. Those vith the 5,512-gallon capacity have take-off weight of 122,200 lbs. These weights are based on the use f automatic feathering of the propellers. Without automatic featherng, take-off weight is limited to 14,600 lbs. (See *Fig. 2*, page *36*)

It is interesting to note that the mpty weight of the aircraft is ome 1800 lbs lighter than that of he manufacturer's guarantee. Here omething new has *not* been added! gain, credit goes to the Douglas rganization.

Air-Conditioning System: Cabn supercharging and ventilation, as or the DC-6, is supplied by two ngine-driven superchargers. One inernal combustion heater supplies abin heat on the ground or in flight. oth an air-cycle and vapor-cycle ooling system supply cooling when equired. An increased cabin differntial of 5.46 PSI provides a comortable 8,000-ft cabin altitude level while the plane is flying at 25,000 eet.

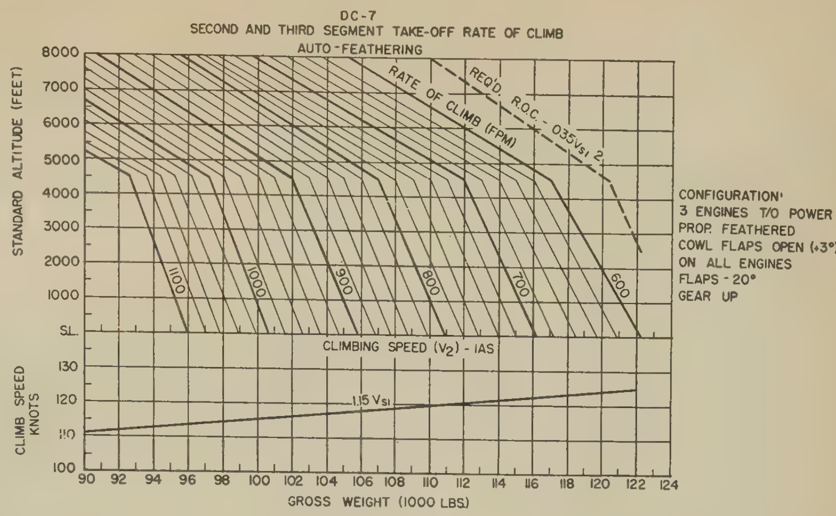
A five-ton capacity Freon refrigration system, developed by Carrier ngineering, is provided for use both n the ground and in flight. This ompact unit incorporates a Freon ompressor, evaporator and recircuator fan in the belly compartment, with a condenser (and blower for ground operation) neatly mounted in the right wing fillet. The complete Freon system adds some 500 lbs to the airplane weight, but the system contributes greatly toward making the airplane self-sufficient and it should reduce ramp congestion by eliminating the need for ground airconditioners. This unit supplements the expansion turbine when engines are operating, giving a total of about 10 tons refrigeration.

The rather heavy electrical load requirements of the Freon system are accommodated by higher capacity ground power (1,000 amp) units for operation of the system at the ramp. The ship's increased-capacity generators are adequate for both ground and flight operation. Temporarily, use of the Freon system is limited to ground operation, but improved condenser fans are expected to be available so that the Freon system can be used in flight by the time warmer weather arrives. Ground use of the Freon system while taxiing or during engine run-up is dependent on all four generators operating.

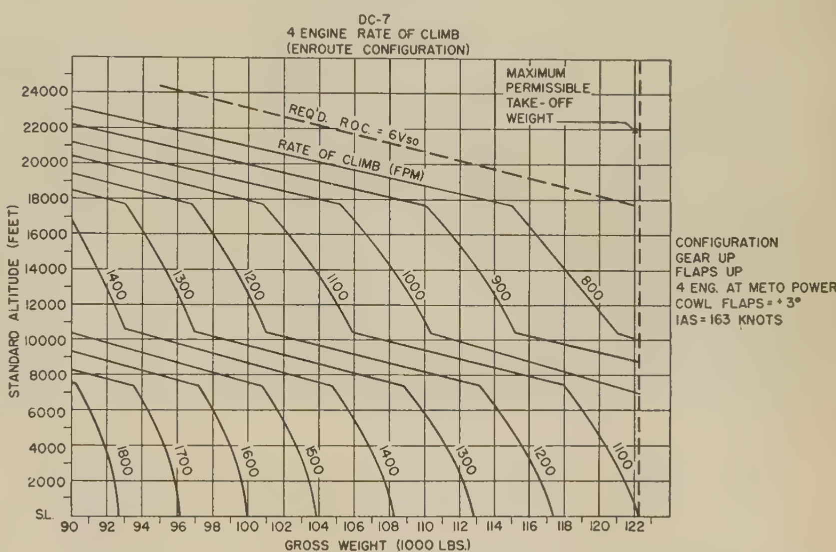
Cabin temperature control and ventilation is generally considered excellent. The forward cabin compartment, however, is somewhat lower in airflow than the remainder of the cabin, although it's perhaps better than many present-day transport aircraft.

Cockpit airflow is good but, as on previous aircraft, the basic temperature setting is dependent on the cabin temperature setting, and this does not

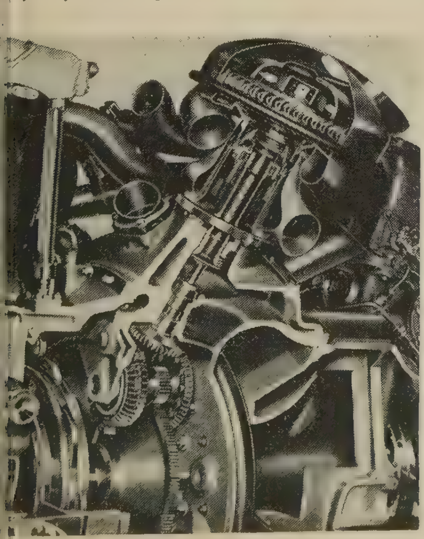
(Continued on page 36)

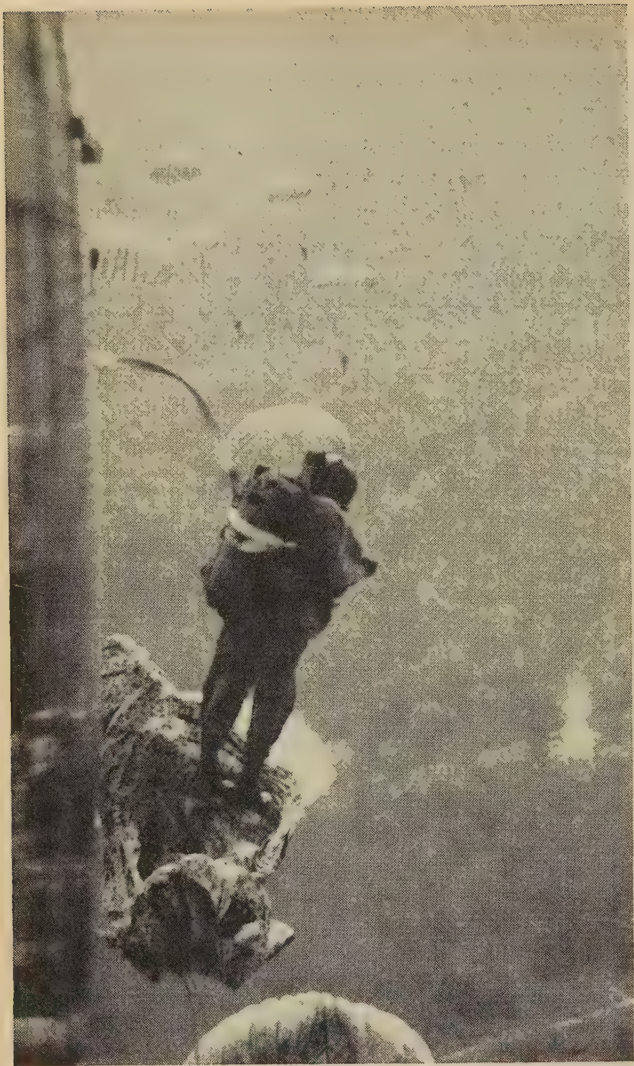


TAKE-OFF *climb of the DC-7 has been improved as result of higher gross weights, wing loading, and lower power loads. Engine-out rate of climb is impressive. Flight demonstration at maximum gross, engine out on take-off, verified this*



POWER *recovery turbines (cutaway of mechanism shown here) boosts shaft power 20% by utilizing waste energy in exhaust*





PARATROOPER *requires special training, equipment. Air movement of men by helicopter is faster, cheaper and much safer*

Paratroops . . .

Operational success of helicopter in actual combat

The veteran paratrooper watched the big green Army helicopters thoughtfully. Armed infantrymen were charging out of the open doors of the whirlybirds even before their landing gears touched down. As the riflemen rushed to battle positions and began firing, other Army 'copters skimmed over the treetops, each with a 75-millimeter howitzer slung under its belly. Within seconds these guns were blazing away at a mythical enemy. As they boomed, other flying "eggbeaters" loaded with ammunition and supplies squatted down to discharge their cargo.

A bemused paratrooper was watching this combat maneuver at Fort Bragg, North Carolina, and to him it spelled a mild revolution in military tactics.

"One of these days," he said to a jump-booted buddy, "those things are going to put us out of business."

While the paratrooper would be likely to find few airborne division soldiers who would agree with him, a growing number of Army and Marine Corps combat officers are steamed up about the potentialities of the helicopter. They think the whirling blades of the choppers are sounding the death knell not only of paratroopers but of trucks as well, and they foresee the time when all infantry divisions will be airborne divisions—helicopter-borne, specifically. Their beliefs are not without basis.

The primary mission of an Army paratroop division is to envelop the enemy's "third flank," landing behind him to seize important hills and ridge lines, highway junctions and crossroads, bridges, supply dumps, airfields, cities or other objectives. It is the paratrooper's job to disrupt enemy traffic by setting up road blocks, to engage enemy reinforcements before they can reach the front lines, and to attack enemy strongpoints from the rear.

No one denies that the paratroopers have done their jobs well in the past or that in the future they may excel their already splendid record. But some Army and Marine Corps tacticians are convinced that helicopter-borne infantrymen and artillerymen—helitroops—can do the job faster, better, cheaper—and more often.

"It takes a lot of special training to make a paratrooper," said one Army officer, "and only the best can make the grade as a jumper. But it doesn't take any special training for a soldier to ride a helicopter. He doesn't have to worry about how he lands on the ground and he doesn't need especially strong ankles, because when he jumps out the door of a helicopter he's closer to the ground than he would be if he leaped over the tail gate of a truck."

Paratroopers not only receive weeks of costly, highly specialized training but they also require more than $400 worth of special equipment each. Infantrymen turned helitroopers require only their normal issue arms and equipment and normal basic training.

Before paratroopers can go into action, they must be alerted and moved by truck convoy—often out of a combat zone—to a rear area airfield where they board troop-carrier planes. A security blackout—necessary if an enemy is to be surprised—is difficult, for it is all but impossible to hide a division on the move. Such a movement may require hours, or even days, and during that time the jump force is of no tactical value whatever.

Helicopters do not wait for troops to come to them. Cruising at 90 mph, they go to the troops wherever they are. A combat unit in reserve within a few hundred yards of the front line may be picked up by helicopters and airlifted over the enemy's head on very short notice.

Whether a scheduled paradrop comes off often depends on the weather. Rain, high winds, or a low ceiling will scrub the mission. In Korea, a jump by the 187th Airborne Regiment was delayed six hours by rain. The air movement of 8,000 men of the 31st Infantry Division from Fort Jackson, S.C., to Temple, Texas, to participate in a maneuver was held up 24 hours by a weather front. Delays such as these conceivably could result in disaster on the battlefield.

Army and Marine helicopter pilots regularly fly in rain or under limited visibility conditions that ground conventional aircraft. It is not necessary for them to boom

or Helitroops

by Major James W. Campbell
Armor, U.S. Army

n Korea as well as in training maneuvers indicates decisive role it will play in future

PIASECKI YH-16 *is Air Force's largest tandem transport helicopter. Powered by two 1650-hp engines, the Transporter can carry 40 soldiers or three jeeps, loaded through tail ramp, shown in lowered position. Copters may eventually replace Army trucks*

along at high speeds. They can—and do—slow down to walking speed when necessary. Many actually would prefer limited visibility when moving troops behind enemy lines, for this would add to the chances for surprise.

Enemy anti-aircraft guns are a major concern of high-flying troop-carrier planes, but they present only a minor problem to ground-hugging helicopters which skim treetops, fly behind hills and take advantage of the cover and concealment offered by canyons and riverbeds. In Korea, Army 'copter men flew nearly two hundred thousand missions. Yet only one helicopter was lost to enemy fire. Army Captain William P. Brake of San Antonio, Texas, flew 587 missions to evacuate 900 wounded soldiers from the combat zone to rear area hospitals. Yet neither he nor his H-13 Bell helicopter suffered as much as a scratch from an enemy shell.

When paratroopers hit the silk, their first concern is not with meeting the enemy but of landing without injury. To insure that their chances of injury are minimized, drop zones are limited to relatively flat, tree-less ground. To drop on hillsides, mountain tops or wooded areas would increase the toll of injuries from bad landings so much that whether paratroopers would remain an effective fighting force under such conditions is highly debatable. Even under ideal conditions—no wind, a sunny day, and perfectly smooth ground—a big paradrop without injuries is rare, and many paratroopers have found themselves dangling head over heels in a maze of tree limbs and parachute shrouds.

These hazards of a parachutist are no problem to helicopter pilots. They can land in any open space the size of their whirlybirds. One 'copter pilot even landed his craft atop the elevator shaft of a downtown Dayton, Ohio, hotel. In Korea, Marine helicopters landed an entire company of 224 Leathernecks on a hill south of Wonsan and evacuated a Republic of Korea unit from the hilltop as a part of the same airlift. Army 'copter pilots have even lowered artillery observers by cable onto thickly-wooded hilltops.

The nightmare of any paratrooper is that some day he may come floating to earth and find himself staring down the barrels of enemy tank guns. Despite the efficiency of any intelligence unit, there is no sure-fire system to guarantee that an enemy won't be nearby to greet a paradrop. The enemy might have been miles away at sunset on the preceding day, but overnight a modern Army can move great distances—and if it got wind of an enemy paradrop it undoubtedly *(Continued on page 14)*

SIKORSKY H-19 *helicopters of Army's Sixth Transportation Co. in Korea re-supplied isolated troops, carried out wounded*

ARMY *flying truck such as H-19 carries 10 armed soldiers. Newer H-34 carries 14, S-56 carries 30, YH-16 carries 40 men*

would. Paratroops have no way of making a last-minute reconnaissance of a drop zone.

In the words of a helicopter pilot, there is "no sweat" on this point. After helicopters are airborne, a small reconnaissance 'copter will hover over the landing area just a few minutes before the attack. If an enemy force has been moved into the area, the attack plan can be changed while the helitroopers are in the air, or called off entirely. A senior officer or commander of the attacking unit can make the inspection himself. Satisfied the area is safe, he would flash the "okay" signal to pilots of the troop-carrying choppers. Then the invasion fleet would ride a radio beam, emanating from the commander's transmitter, to the landing area and set down as a unit.

Once a paratrooper has made safe descent into a drop zone, his next task is to round up his fighting gear—which may have dropped a half mile or more from where he landed. In Korea, an artillery commander could find only two of his battery's six guns which had been airdropped. After the trooper has rounded up his equipment, he then must join up with fellow members of his platoon. Frequently this is impossible because his buddies have dropped over such a wide area, and the paratrooper finds himself a member of a makeshift unit under leadership of a strange commander. Worse still, he may find himself alone and hopelessly lost.

But when infantrymen and artillerymen step out of a helicopter, they are an organized unit ready to fight—and the other squads of their platoon and other platoons of their company are no more than a few yards away. They carry their weapons—including "hip pocket" artillery pieces—with them. The unit commander is first to alight, and as the fighting soldiers dismount they rally under his leadership within seconds. They are an effective fighting force the instant they touch down, and reinforcements arrive rapidly as empty helicopters take off to make another round trip.

Paratroopers, once committed, must depend on supplies dropped by parachute from transport planes. In tight situations, a slight change in the wind or a minor miscalculation by a pilot may result in the food and ammunition falling into the hands of the enemy. At best it is scattered over a large area.

This couldn't happen to helitroops, for the same 'copters that fly them into battle also re-supply them.

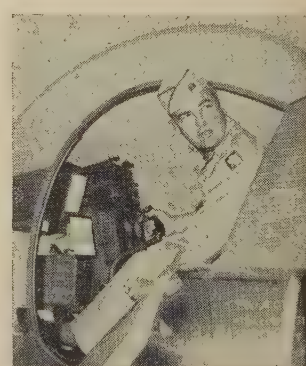
Even the most daring commander always tries to keep open an avenue of escape, should it become absolutely necessary to withdraw in the face of an enemy. But once paratroopers are committed, there is only one escape route: They must link up with advancing ground troops. Wounded paratroopers must be treated on the spot, and there is no way in which they can be evacuated quickly to a rear area hospital. Only after the link-up can they hope for hospitalization.

While no commander likes to think of quitting a battle until victory is won, such eventualities must be considered. If it became necessary for helitroopers to break off an engagement, the same rotary-winged aircraft which carried them into battle also could carry them out. Evacuation of wounded in such engagements is a regular part of the training given Army and Marine Corps 'copter pilots, and even after a strike at an enemy's rear areas soldiers wounded in the fight could be flown directly to hospitals in a matter of minutes.

The Army and Marine Corps had been experimenting with helicopters prior to the outbreak of war in Korea. As a result of experiences in Korea and maneuvers in this country, both stepped up their training of chopper pilots.

During the past three years, the Army has trained more than 600 men to fly the whirlybirds, and this year (1954) 700 more will graduate from the Army Aviation School at Fort Sill, Oklahoma. The warrent officers who fly the H-19 Sikorsky troop carriers arrive at Fort Sill without previous flight training. Nineteen weeks later they are qualified 'copter pilots. The men who fly the smaller reconnaissance helicopters—H-13 Bells and H-23 Hillers—are given preliminary *(Continued on page 48)*

EVACUATION *record for copters during 14 months service in Korea was set by Capt. Wm. P. Brake of San Antonio, Texas. He flew 587 missions to evacuate 900 wounded soldiers. Capt. Brake is now helicopter instructor at Fort Sill, Okla.*



Single-Engine IFR

by Capt. G. A. Edwards

Experiences of successful business and professional pilots provide a guide as to what weather can be flown safely in single-engine planes

The scene was an airline ticket counter at the Macon, Ga. airport. Local weather conditions reported at Macon were ceiling 1,000 feet ragged and visibility four miles, with a downward trend. An airliner was due in northeast-bound to Atlanta. Across the counter from the airline clerk were two businessmen, and from the conversation it was apparent both were pilots.

The younger man was trying to obtain space to Chattanooga for the two passengers he had flown to Macon in a company-owned *Bonanza*. The airline clerk was sympathetic but not very helpful.

"Flight 402 is booked solid out of here to Atlanta," he reported, "and besides making connections out of Atlanta doesn't look good. Delays in the holding stack are running quite high."

"I know" the younger business pilot replied, "Chattanooga is forecasted to open within the hour, Memphis and Nashville are clear, but Atlanta is too low for my taste to fly over single-engine and I don't buy VFR with 800 feet and three miles in that area!"

The older business man took on a patronizing expression as he spoke up.

"You don't know this country like I do. They always report it worse than it is. If I don't get on this airline flight, I'm going to take a look at it VFR with my little old puddle jumper out there."

As the clerk and the other pilot looked out at the small private plane sitting in front of the hanger, the younger pilot commented on the absence of anything but a low-frequency radio antenna.

"Sure," the older businessman replied, "I don't have your fancy VHF or ILS but there's always GCA if I get into trouble!"

In answer to the implied question on the face of the airline counterman, the younger pilot mentioned his type of airplane and that he had a six-hour supply of gas. full instruments plus Omni, ADF, ILS and more than the required recent instrument time, simulated and actual.

"But that's not enough for me," he added, "when Atlanta goes below 800 feet and ATC advises there will be an indefinite delay for any altitude below 6,000 feet, the forecasted icing level! The top of the clouds here is reported as 4,000 feet, but there's a high stack at Atlanta with nobody reporting on top! If your flight is not available, I'm going to investigate the possibility of an end run around the south edge of the front via Columbus, Montgomery and Birmingham, and get my passengers to Chattanooga that way."

To shorten the story, the airliner came in full and departed without taking on anything but gas. Atlanta closed down just after the take-off and the captain elected to return Macon and cancel his flight.

The older private-plane pilot "took a look at it" after the airliner departed but was out of range or not listening when the range operator tried to advise him of the change at Atlanta. About half-way to his destination low ceilings forced him into the tree tops, destroying his airplane and injuring himself.

The younger and more professional business-plane pilot checked and found that ceilings averaged 800 to 1,000 feet with two to three miles visibility at stations along his proposed alternate route, with improvement to the west—including CAVU at Memphis and Nashville for desirable alternates. He filed for "five-on-top" direct Columbus (off airways), was approved at 4,000 feet airways to Montgomery and at 5,000 feet to Birmingham and Chattanooga. The flight took more than twice as long as the direct route, but the pilot was on top almost all the way.

On arrival Chattanooga, there was a 10-minute delay while an aircraft, diverted from Atlanta, completed its approach; then an ILS approach through broken to scattered clouds. He was underneath and VFR at the Outer Marker and landed his passengers in time for a half day's business.

The subject of single-engine instrument flying ranks among the most controversial of "hangar-flying" subjects. Usually the lines are easily drawn. The lads fortunate enough to be flying multi-engine aircraft are no more critical than the wishful novice pilots or the non-rated "experts" who have had the pants scared off them, to which fact they somehow seldom allude!

It is hard to find the lad who will talk about it; who is not only doing it but is qualified to explain how and why he is still around. Yet, it is from the experiences of these successful business and professional pilots flying IFR single-engine that we must draw the information and techniques that serve as a guide as to what kind of weather and situation can be flown single-engine without inviting disaster.

Since even the multi-engine boys with all their assured advantages occasionally come a cropper, it is evident that the number of fans out front is but a factor to be considered when contemplating IFR operation. The experiences of the many pilots from whom the following *suggestions* were drawn, indicate that they are flying close to 90% of the weather, which is so good that the airlines a few years ago bragged about such a figure. The inference is clear that the remaining 10% represents those occasions on which either summer thunderstorms or winter ice could not be circumvented, or conditions generally were below those considered adequate and there were no acceptable alternate plans of action.

Although a pilot's ability and weather judgement are obvious prime factors in any IFR flight, let us first consider the airplane requirements. *(Continued on page 62)*

by Frank L. Harvey

SERVICE . . . and SALES

Southwest Airmotive serves individual plane owners as well as the airlines, and in 1952 it pumped some 3,500,000 gallons of gasoline

It had to happen sooner or later. Somebody had to shoo the hangar flyers out of the back room, and sit down and think deeply and seriously about how to make money with a fixed-base operation. For this fixed-base business had been sick—in fact, so sick that an operator who lived on the GI Bill and gave no thought for the morrow is now selling shoes in somebody's bargain basement.

It's a real pleasure, therefore, to set forth the story of a healthy fixed-base operation that pumped enough gasoline in 1952 to float a battleship (3,500,000 gallons), serviced 8,000 executive-type airplanes, dispensed $1,300,000 in payroll, and racked up a fabulous $5,600,000 in gross sales. That operation is Southwest Airmotive which sells parts, overhauls engines, rents hangar space, converts executive aircraft and is known as one of the most successful organizations in the entire world of aviation. Southwest is based at Love Field, six miles from the heart of downtown Dallas, Texas. Much has already been written about Southwest and it is not the purpose of this piece to recount dead facts. Instead, we want to pick out the essential details which seem to have been responsible for Southwest's success and to present them for the benefit of anyone who may want to do likewise.

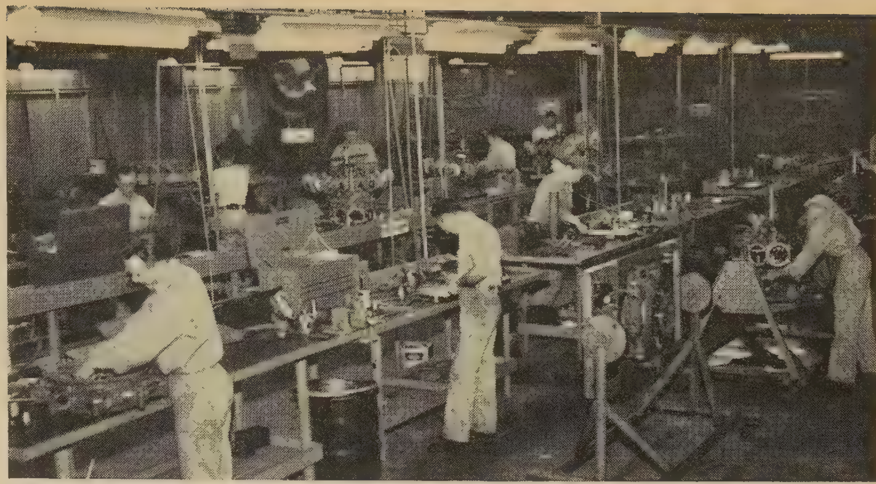
The pivot point has been *foresight.*

After the war, hundreds of folks dived into aviation to train pilots under the GI Bill. Southwest, already well established, put six salesmen in four company airplanes in the air to cover many newly organized flight schools all over the Southwest area. It cost roughly $20 to make a call, whether the salesman landed a big order or merely (as was often the case) killed a few hours in the back room swapping stories because the operator had no business for him. Finally, Southwest realized they must find new markets for their parts. Ten calls sometimes only resulted in the sale of a bucket of bolts. Rather than muddle along, hoping that tomorrow would be better, Southwest had the foresight and the common sense to eliminate the whole six-man, four-plane operation.

The profit, they realized, would come from serving both the small operators and the big steady finan-

LOVE FIELD *in Dallas is home base for Southwest Airmotive. This photo was made on a Fall weekend when executive aircraft and private planes swarmed to Southwest and parked on its sprawling 30-acre concrete ramp while owners attended a football game*

cially sound customers—the airlines. Here was Southwest, spending large sums of money merchandising, advertising and canvassing, and their best customer was walking right past their door—and giving orders direct to the manufacturer. Southwest Airmotive was in a perfect position to render service. They had lined up distributorships for Aircraft Radio Corp., BG Corp., Bendix Products Div., Eclipse-Pioneer, Scintilla Magneto, Bendix Pacific Div., Bendix Red Bank Div., Champion Spark Plug Co., Electric Auto-Lite Co., Flottorp Mfg. Co., B. F. Goodrich Co., Hamilton Standard Propellers, Lycoming-Spencer, Packard Electric, Pratt & Whitney Aircraft, RCA, Wright Aeronautical Corp., and others. The sources were assured.



ENGINE SHOP *specializes in overhaul of Pratt & Whitney R-985 engines on an assembly-line basis. Smaller and larger engine types are re-built individually off-the-line at Southwest*

"We'll do our best to sell the airlines," Vice President-Sales George Jalonick told the staff. "It will take time and money, but let's make a real effort to do it."

They started off with American Airlines whose maintenance base was at Tulsa, Oklahoma. American was skeptical.

They had always dealt directly with the manufacturer and they frankly did not believe Southwest could give them the same discounts, engineering help, and other attention they had been accustomed to receiving from the manufacturers.

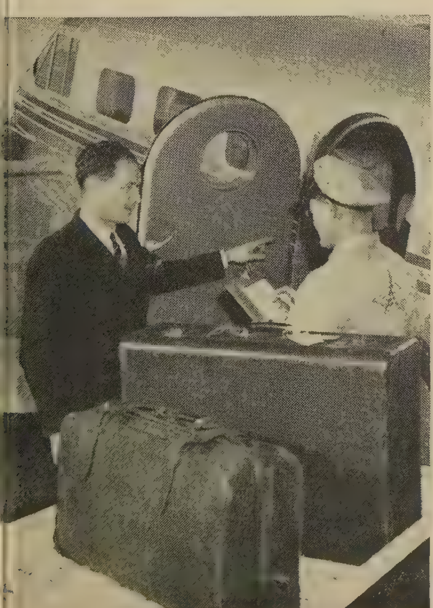
"If we let you move into the picture," American explained to Jalonick, "we may lose the direct pipeline to the manufacturer which is so important to us. You'll be just another middleman, and the business is already too full of middlemen."

Jalonick does not fold up in the clutches. "We are *not* just another middleman," he said calmly. "If you use us, you'll get a number of specific advantages you don't have at this moment. For one thing, we'll be spending *our* money for *your* inventory. If a part becomes obsolete, we'll be holding the bag, not American. We'll be paying the freight charges from the manufacturer to our warehouse and you'll pay freight only from Dallas to Tulsa. And as far as losing touch with the manufacturers, I'm willing to predict that your relations with them will *tighten up and improve*. Anyhow, it won't cost anything to give it a try."

American reluctantly agreed to make a trial run. They permitted Southwest people to come in and make a thorough study of the problems involved. This "study period" cost Southwest a lot of money and nine months of time, but it paid off in the end. When Southwest finally announced that they were ready to start rolling, things moved on oiled bearings. Southwest had prudently decided not to try to supply all of

(Continued on page 46)

BUSINESS-PLANE *service includes baggage handling, free clean-up of plane's interior*



SOUTHWEST *bosses, Vice Pres. G. W. Jalonick, III, (left) Pres. Harlan Ray carry out company tradition of turkey in every basket at Christmas. Recipient here is a shop mechanic*

by William A. Dixon
Captain, TWA

Stop-Distance in Landing

A competent pilot knows optimum technique for landing within shortest distance possible so he may land with confidence on any type of runway

The big Connie came gliding in through a light rain, but instead of the nose wheel gently drifting down and contacting the runway about the middle of the landing run, the pilot immediately eased it on in a very deliberate action.

"Too bad," one airport visitor remarked, "he let the nose wheel drop off on him. And that looked as though it were going to be a slick landing." What our self-styled expert didn't realize was that the technique for landing on a wet runway—and in this case, an asphalt one—is a lot different from that usually used on a dry runway; it is, that is, if the pilot wants to stop within the confines of the airport.

In this instance, the pilot was bringing in a heavy airplane on a relatively short runway and it was raining. He pushed the nose wheel on at once, called for UP flaps and started easing on the brakes, firmly but carefully so the wheels wouldn't skid. The landing didn't appear too hot and it didn't extract any compliments from the passengers, but it was the correct technique to secure the shortest possible roll on a wet runway. It was a good professional landing designed to meet the prevailing runway conditions.

This business of landing is complicated by many factors, but pilot technique is probably the most important. Just about any pilot can slide by on a long runway, literally and figuratively. But the competent airman knows the optimum technique for landing within the shortest distance possible so that he may land with confidence on any type and condition of runway within the capabilities of his airplane.

Trans World Airlines, which operates over 100 Martins, DC-3's, DC-4's and *Constellations*, has listed the following in its Flight Operations Manual as the key factors affecting stopping distance:

a. Landing technique used by the pilot.
b. Touch-on speed.
c. Frictional available between the airplane tire and the runway.
d. Wind.
e. Weight of airplane.
f. Air density.
g. Slope of the runway.
h. Position of the C.G.

A mathematical expression embodying the above components is available. By substituting different values for a single variable, while holding the others constant, it is possible to observe the effect of that particular variable. The accompanying chart *(Fig.1)*, prepared by TWA's Capt. E. A. Feazel, graphically il-

PILOT *technique for landing is dictated by weight of aircraft, condition of runway*

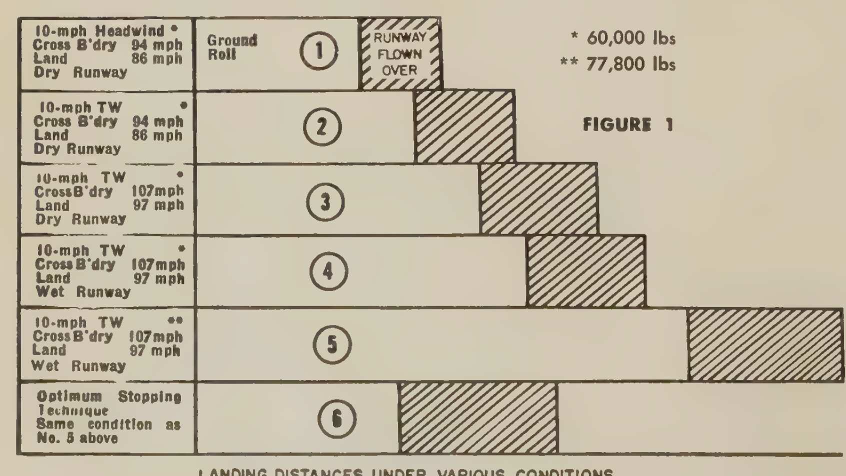


FIGURE 1

LANDING DISTANCES UNDER VARIOUS CONDITIONS

ustrates how these factors affect the anding distance of a Lockheed *Constellation* without reversible propelers.

The chart assumes for Distance 1 through 5 a constant landing technique utilizing 100% flaps, cross end of runway at height of 10 feet, touchon the main gear, nosewheel down at 70 mph IAS, no braking applied until nosewheel is down, full braking from the instant the nosewheel touches, flaps remain extended until plane is stopped.

Item 6 on *Fig. 1*, "Optimum Stopping Technique," is the only instance in this illustration where pilot technique is varied. Here, the pilot put the nosewheel on the runway as soon as possible instead of waiting for the IAS to slough off to 70, and picked up his flaps at once.

Note what a difference this made. This was because maximum braking became immediately available. The weight of the airplane was forced on to the pavement, lift was reduced to a minimum, and the brakes absorbed the energy. The aerodynamic braking of extended flaps and nosehigh altitude is peanuts compared to wheel braking.

Of course, if you have lots of runway and want to turn off at the end, it would be silly to immediately jump on the brakes. But right now we are talking about the times we want to slow down fast.

The *only* condition under which aerodynamic drag is preferable to use of brakes is when virtually no wheel braking is available. This situation might be the result of either complete brake failure or smooth wet ice.

According to Capt. Feazel (who is the source of all the charts in this article and an aeronautical engineer in his own right), the point at which aerodynamic drag exceeds wheel braking varies a bit, depending on the wing loading of the aircraft, but it is always at a coefficient of friction so low that it is rarely encountered. The safest rule is to seek maximum wheel braking if a short roll is desired.

The point of incipient skid is the optimum braking condition. The pressure required will vary with runway surface. A heavy foot would have trouble shredding the tires on a dry concrete runway; the same pressure on a packed snow surface could produce some fancy sledding.

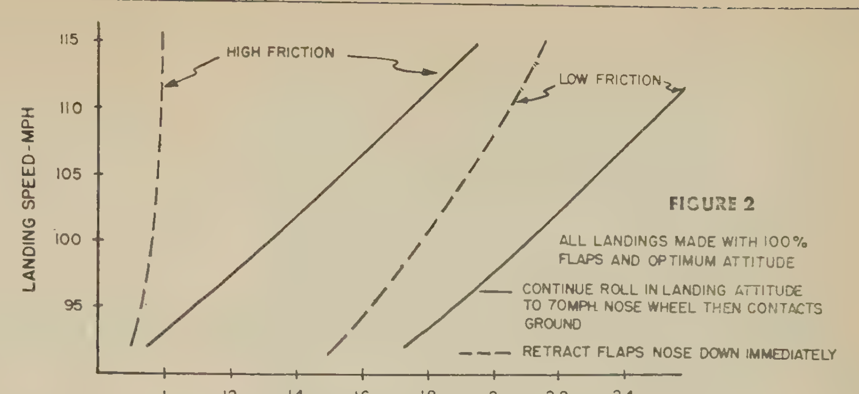


FIGURE 2

EFFECT OF SPEED-CONSTELLATION

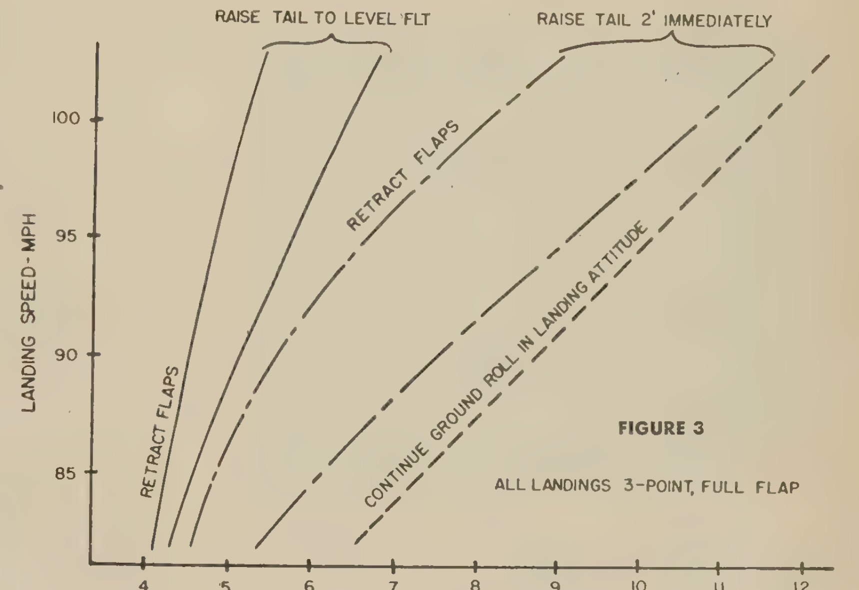


FIGURE 3

DC-3 EFFECT OF LANDING TECHNIQUE

It demands technique and experience to know just how much pressure to apply and when to ease it off. Skillful "feeling" for the brakes is required. The energy absorbed by the brake discs during a skid is *zero!* Probably one of the most tricky conditions is a runway plagued with wet or icy spots. One wheel may brake normally for a moment while the other skids. Add in a crosswind and even the most experienced pilot must exercise the utmost caution.

On the subject of non-skid brakes, during CAA-supervised tests on an ice-coated runway, a B-377 equipped with such a non-locking, fail-safe device on the wheels, was stopped within 50 feet of the runway length for accelerate-stop distance as specified by the CAA for *dry* runway conditions! Normal wheel braking is available should a malfunction occur.

Braking is merely the controlled use of friction which is defined as "the resistance to movement when one surface moves across another." Coefficient of friction is a unit measure of this resistance. Specifically, it is the ratio of the decelerating force to the force pressing the surfaces together. If the coefficient is high, the resistance is strong; conversly, if low, the resistance is weak.

In material Capt. Feazel prepared, he declared that the decelerating force attributable to wheel braking is proportional to the coefficient of friction multiplied by the force pressing the surface together (weight of plane on the wheels). There are but two

(Continued on page 42)

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

FEBRUARY 1954

Park-Plaza Hotel, St. Louis, Mo.

Operational Safety for Business Aircraft

Discussion discloses key to traffic problem in congested areas lies in good equipment, crew proficiency; pilots agree no additional regulations are needed to govern business flying

Moderator Ed W. Hudlow *(Chief, General Safety Div., CAA)*: "This matter of operational safety for business aircraft is a never-ending search for better ways to do things. It's a constant struggle to get safer transportation from existing equipment and to create new equipment having a greater capacity for safety. There is no room for complacency in safety. Significant testimonials to the safety that can be achieved in business aircraft operations are found in the fact that they furnish daily transportation to the most important executives in the world. These operations prove beyond a doubt that where there is a determined will to operate safely, it can be done.

"Many people consider safety a mechanical problem. Quite to the contrary, it is a problem of human behavior. It is one thing to talk safety . . . and quite another to practice it. An essential ingredient of safety is a healthy attitude toward it.

"The operators of business aircraft are to be commended for their contributions to safety and their increasing utilization of aircraft for business purposes. Thus, for the discussion today, I suggest that we begin with those phases of operational safety which you feel could be further improved, modified or eliminated. Perhaps the lead topic should be the relationship between management and the pilot."

E. Tilson Peabody *(Director, Air Transportation Section, General Motors Corp.)*: "I believe what you are referring to, Ed, is what we sometimes call 'executive pressure,' either real or implied. There is a way by which the operator of one airplane or a fleet of aircraft can reduce the possibility of this so-called 'executive pressure' which tends to force the pilot to extend himself beyond his rational abilities. It can be done by setting up a 'buffer stage' between the pilot and his executive passenger, and it is set up to take the pilot off the spot in critical conditions of weather where decisions have to be made under adverse circumstances. A detailed and agreed-to policy should be established which specifies that the particular operation will be conducted according to the published minimums in the Flight Information Manual. Then the pilot would have no critical decisions

ROUND TABLE *participants at St. Louis were (left to right around table) E. Tilson Peabody, General Motors; I. T. Holman, Sears, Roebuck & Co.; R. W. Lane, Food Machinery & Chemical Corp.; Herbert O. Fisher, Port of N.Y. Authority; C. F. Zimmerman, Continental Oil; Tom R. Neyland, Albert Trostel & Sons; Sidney F. McCullough, ASDO, CAA; Bennett H. Horchler; Curtis G. Talbot, General Electric; George W. Vaughan, of Phillips Drilling Corp.; Edw. W. Hudlow, Chief, General Safety Div., CAA, Washington, D.C., who served as chairman of the meeting; and F. H. Langenfeld, representing Monsanto Chemical Company*

to make regarding 'go' or 'no go' when the weather is below those minimums; he would cancel or reroute according to policy. Or the policy could be more general and state that a flight will never be made against the pilot's will.

"Once that policy is established and approved, then the pilot, regardless of executive pressure, or pressure without intent, merely refers to the policy and says, 'I'm sorry, but I do not consider it safe. The flight must be cancelled.'

"In larger organizations, this 'buffer stage' could be set up within management itself, through a manager or chief pilot or director who then relieves the pilot of the direct responsibility to the executive of canceling the flight."

C. F. Zimmerman *(Supt. Aviation Operations, Continental Oil Co.)*: "The company pilot should try to educate his passengers to know he is thinking of his own safety as well as theirs; then, if a pilot needs to land due to weather, his passengers will have a feeling that he is looking after their welfare as well as his own.

"There is no compromise for safety. You can't relax with it. You have to keep at it at all times. I know that in our company if we wish to land and put passengers on a train, there is never any question about it, because the passengers know the pilot thinks a lot of his own neck as well as their welfare."

Ed W. Hudlow: *"In other words, you think that in addition to establishing a company policy the pilot should sell the executives on the fact that he, the pilot, is thinking of safety for himself as well as the passengers."*

C. F. Zimmerman: "That's right. You can have a chief pilot on a home base, but when a pilot is 1500 miles from home, he has to make his own decisions."

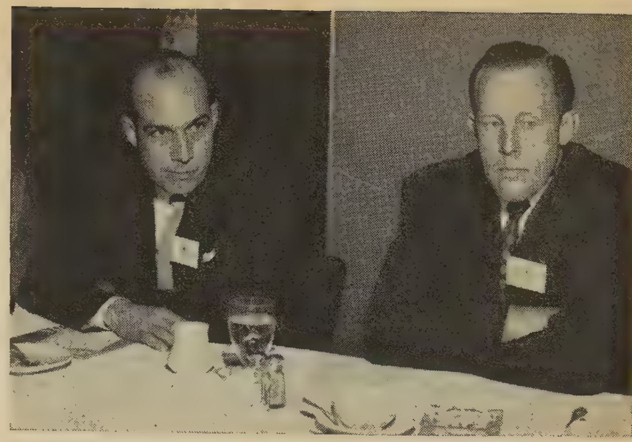
George W. Vaughan *(Chief Pilot, Phillips Drilling Corp.)*: "Mr. Zimmerman is right. Management should be educated regarding the type of weather the equipment is designed to fly. In our operation we have a *Bonanza* that is limited to daylight contact flying, and we had to go through quite a transitional period in which we had to get management to realize that while we could fly one airplane in all weather and at night, the other one had to be limited to daylight contact operations.

"We feel that the chief pilot in any corporation should set up definite minimum weather conditions that are flyable, commensurate with the equipment. Under no circumstances should the pilot violate or be allowed to violate those regulations. Copies of those established minimums should be given to management so that they won't expect the pilot to violate them."

Ed W. Hudlow: *"The second problem to be discussed is: 'Is management sympathetic toward a pilot's request for better equipment, better maintenance, etc., or does management expect the ultimate and then provide only the barest essentials?"*

I. T. Holman *(Pilot, Sears, Roebuck & Co.)*: "In our company, management is definitely in sympathy with the pilot's requests. We've been told very clearly that management does not want to spare any expense in getting the safest equipment possible. Safety is stressed equipment-wise, maintenance-wise and pilot-wise."

Tom R. Neyland *(Chief Pilot, Albert Trostel & Sons Co.)*: "The answer to that question is one that varies with each company. Again, you have to educate the



"SAFETY *is stressed in our operation, equipment-wise, maintenance-wise and pilot-wise," reported I. T. Holman (above, left) of Sears, Roebuck. Sitting on Mr. Holman's left is R. W. Lane*

"PILOT *flying for a corporation should have an Air Transport Rating," declared George Vaughan (above center), sitting between Moderator Ed Hudlow (right) and Curtis G. Talbot of GE*

people who buy airplanes or who think they want airplanes. Many companies that have been flying business aircraft for some time realize what it takes to fly all-weather. On the other hand, I know of companies and of pilots, too, who let themselves be put into positions they shouldn't be in, where they are operating when they shouldn't be and doing it on a minimum of equipment. That's a big factor, I think. People that have never before been in the airplane business buy second-hand equipment, hire a pilot who's not quite up to what they need, and then they want to go every place everyone else goes. Fortunately, most companies realize what is necessary for that kind of operation, and they spare no expense in making their aviation division as good as any other."

Ed W. Hudlow: *"Mr. Fisher is concerned with the safety problem in the New York area. Herb, would you comment on properly equipped aircraft and pilot efficiency."*

Herbert O. Fisher *(Chief, Aviation Development Div. Port of N. Y. Authority)*: "We have a very critical airport community relations problem in the New York area. We also have one of the most complex network of airways in the country and, as you all know, those airways are really busy. The four Port Authority airports handle some 1800 movements or more a day and, in

Round Table Participants

EDWARD W. HUDLOW (above), chief of CAA General Safety Division in Washington, served as Chairman of the Round Table. A licensed pilot, he began his government work in 1937; went to Washington in 1941.

GEO. W. VAUGHAN Chief Pilot of Phillips Drilling Corp., organized the company's aviation department in 1947. Prior to that he was Supt., Flight Operations, Slick Airways. He was Lt. Col., ATC, during the war.

E. TILSON PEABODY, Director of Air Transport Section, General Motors Corp., learned to fly at Pensacola in 1935. He left Navy in 1940; became test pilot for P&W, associated with GM Flight Operations in 1942.

S. F. MCCULLOUGH, Supervising Agent of CAA Aviation Safety District Office # 17, St. Louis, holds an ATR, Flight Navigation Certificate, A&E ticket and Ground Instructor Certificate. He joined CAA in '43.

HERBERT O. FISHER, Chief, Aviation Development Div., Port of N.Y. Authority, spent 14 years as engineering test pilot for Curtiss-Wright before taking present position; began flying 1928; has over 10,000 hours.

I. T. HOLMAN was a Naval Aviator in World War II; flew for United Air Lines from 1946 to 1951; joined Sears, Roebuck as pilot in '51. He is LCDR, serving as plane commander in Naval Reserve Transport Sq.

TOM R. NEYLAND, Chief Pilot for Albert Trostel & Sons Co., began flying in 1934 and has been active even since as a flight instructor, an airline pilot and a military pilot. He became a business pilot eight years ago.

R. W. LANE, Chief Pilot for Food Machinery & Chemical Corp., was an Air Transport Command pilot during World War II and was awarded DFC and the Air Medal. He holds an ATR, has been with FM&C since 1947.

CURTISS G. TALBOT has been associated with aircraft activities at General Electric since 1940; is presently Manager, Flight Test Section. Mr. Talbot holds Commercial Pilot rating, single, multi-engine; helicopter.

F. H. LANGENFELD, Sales Engineer, Functional Fluids Div., Monsanto Chemical, spent eight years with airlines (TWA, Philippine Airlines, Ethiopian Airlines, North Central) as operations supervisor; joined Monsanto '52.

C. F. ZIMMERMAN, Superintendent of Aviation Operations, Continental Oil Co., has been an active pilot for 19 years; was with Air Transport Command during World War II; also spent two years with the CAA.

addition, there are a number of military airports and smaller private airports in the vicinity. Thus, it is obvious that that area, under instrument conditions or even near-instrument conditions, is no place for any pilot who is not completely proficient in instrument operations. A comment was made a minute or so ago about some companies which may have inferior equipment or pilots not up to standard in proficiency. Such pilots or planes (whether they be private, business, airline, or military) have no business in a busy terminal area under instrument or near instrument conditions because they endanger the safety of other planes in the air and of the millions of people who live near the airports.

"Pilots who consistently fly in and out of New York know the airway traffic picture and are obviously better qualified to fly into that area; but the pilot who enters our area or only flies IFR occasionally may well fall into the category of not being proficient enough to negotiate safely through this high density network of complex airways. He is the potential accident about to happen and is the one who can create a serious community problem for any airport. If he piles up due to ignorance or carelessness in any area adjacent to an airport, it cannot help but be detrimental to the entire aviation industry. Business pilots have flown millions of miles and have built up an unexcelled safety record. I am sure you all agree that we should not risk having that record spoiled by a pilot who 'thought' he could make it."

Curtis G. Talbot *(Manager, Flight Test, General Electric)*: "In our operation, we are aware of the New York traffic problem inasmuch as about 90% of our flights go to either New York or Washington, and if there is any deficiency in equipment or crew, it certainly becomes apparent. Such operations not only justify but require the best and an ample quantity of the latest in communications and navigation equipment, plus top pilot proficiency. With each of our crews making from two to five trips each week into the N. Y. area, this proficiency and familiarity with N. Y. traffic procedures is maintained at a high level.

"To point up the seriousness of the N. Y. area traffic problem, the delays that are frequently encountered are of such duration, sometimes *(Continued on page 50)*

"MORE REGULATIONS *are not necessary now," stated Mr. Zimmerman (right, sitting next to Herb Fisher). "If business-flying record of safety deteriorates, then we can call for more of them."*

complexity of

MILITARY ELECTRONICS

By R. J. Nordlund
Bombing Consultant, Armament Laboratory, WADC

Automaticity and, therefore, complexity will have to increase in proportion to the rate of increase in speed, altitude in plane operation

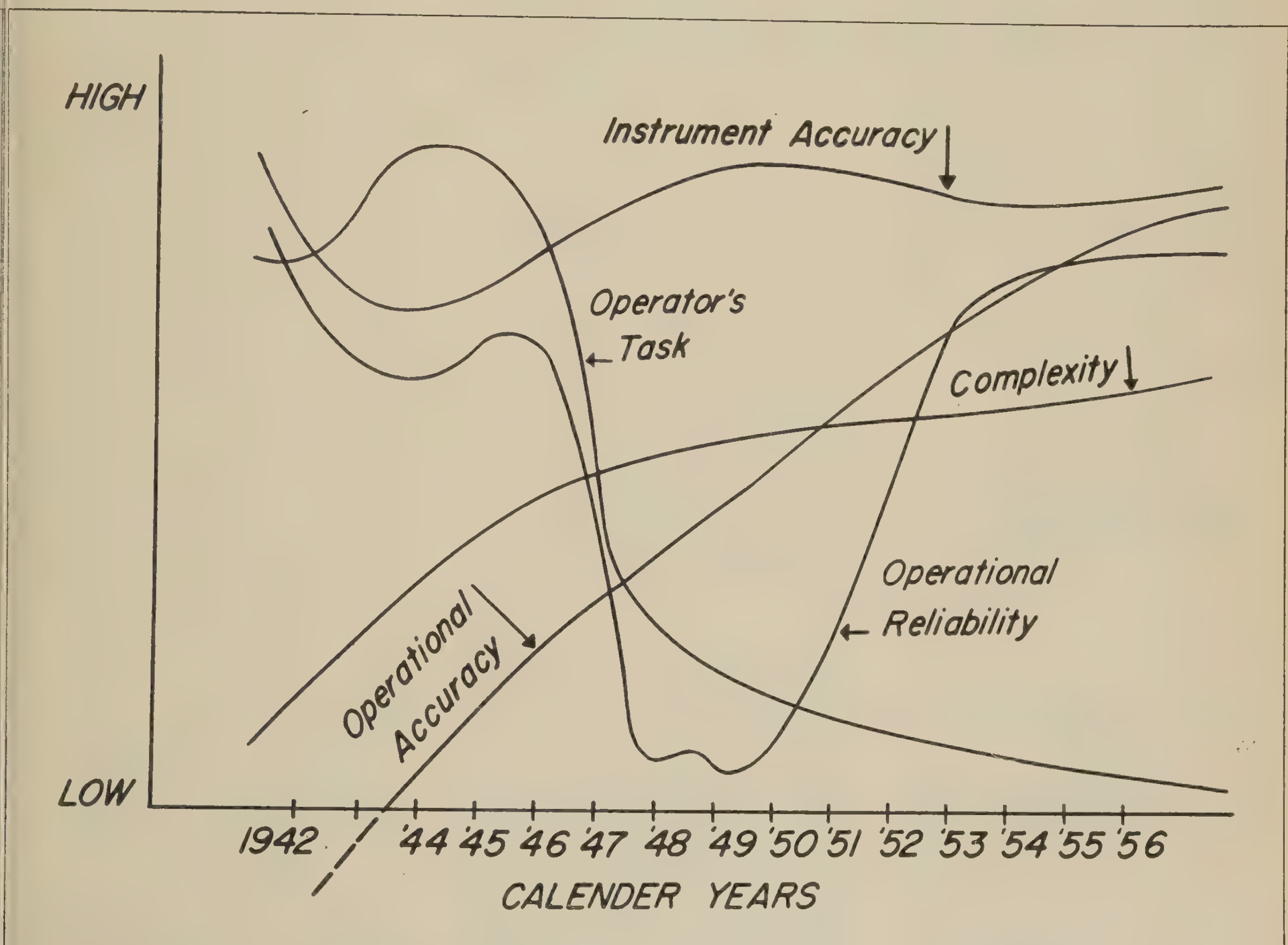


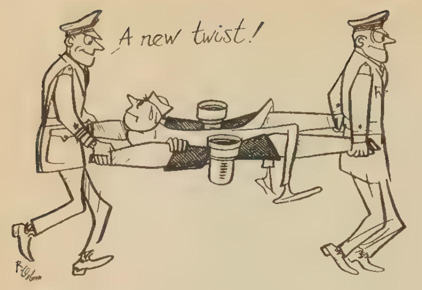
FIG. 1—*"Operational Accuracy" curve shows a steady rise, and proves that decision in favor of complexity was sound*

Many people believe that the military departments have gone off the deep end in the matter of system complexity. Statements have been made, in the press and elsewhere, to the effect that we are soon going to attain push-button warfare. This seems to imply the replacement of the human as part of the basic system. Certain of the more intricate circuits of the computation type are rather thoughtlessly called a "brain."

I think you will agree that the most important contribution of the human in a servo loop, in a dynamic situation, is his ability to reason and correct a wrong trend or event if and when it occurs. With most humans, this is true only so long as events occur at a reasonable rate, so that confusion does not occur and emotional stability is not upset. On the other hand, electronic instrumentation can be devised which can perform certain functions at an extremely rapid rate without confusion. Even a perfunctory analysis of almost any branch of air warfare immediately shows that one of the inherent ingredients of any such battle is an ever-changing situation to which reasoning power can be profitably applied. It becomes immediately apparent that an optimum combination of human and instrumentation must exist for the most precise solution of any given dynamic problem. The faster and higher an airplane flies, the more necessary this becomes. In fact automaticity, *(Continued on page 42)*

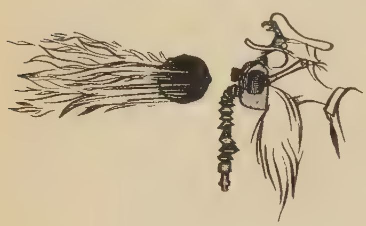
Performance

from the Files of the Flight Safety Foundation



PROP WASH STARTER

Ingenuity is the order of the day, judging from an item appearing in *Naval Aviation News* recently. A C-54, carrying a passenger for emergency polio treatment, sat on the runway with one of its four engines out of action because of a burned out starter. Another pilot, flying an R6D, was notified of the emergency and promptly did something about it. He parked his R6D 10 feet in front of the C-54, set his brakes and turned up his engines. The propwash from the R6D caused the propeller of the C-54's dead engine to spin and the engine burst into life. The mercy mission C-54 took off, followed the same procedure at its next refueling point, and the polio patient was delivered to Honolulu for treatment.



OXYGEN MASKS AS SURVIVAL GEAR

In the same issue of *Naval Aviation News*, "Grampaw Pettibone" points out that the oxygen mask can do double duty. It will help protect a pilot's face from fire and will absorb a considerable portion of the impact forces in an aircraft accident if the wearer is involved in an expected crash.

WARMING UP

When an airplane is being "warmed up," the picture that comes to mind is that of engines being run to warm them up. In cold weather, however, it is also necessary to warm up the gyro instruments for dependable operation. A recent incident occurred to prove this.

The outside temperature was far below freezing; the engines were warmed up; and the gyro instruments were run up to rpm for about 10 minutes. The pilot took off, but the gyro instruments would not return to position after a turn.

For air gyros, minimum cockpit temperature of 7° F is necessary for operation. Electric gyros should be run before use, but require no external heat.

LANDINGS IN WET WEATHER

Several times every year an air transport landing in rain runs out of runway. The pilot blames the brakes, but the brakes check out satisfactorily. A possible explanation of this rather common occurrence might be included in the following, a typical case:

1. The captain consciously maintained more than average speed to contact at nearly 100 mph IAS.

A wind shift noted by the weather bureau immediately after the accident gave the plane a 9-mph wind from the west. (The aircraft landed toward the SE.)

The contact point was established by back tracking the wheel marks. This contact point was in an area of many such marks . . . it was one of the longer taper type.

2. Near the far (SE) end of the runway, the wheel tracks veered slightly to the left but did not reach the runway's edge. Coincident with the start of this curve in the track, the tailwheel track became visible and it swung over to within 5 feet of the right wheel track.

3. The investigator examined the wheel tracks of several aircraft, tracks which were made during unsuccessful efforts to stop within the airport, or runway limits. In several cases those sets of tracks differed from other wheel tracks in the same area. In each of these several cases, the overshoot occurred on a drenched runway, and in each case the tracks were visible for days, even weeks after the accident occurred. Similar characteristics were noted on concrete runways and on black-top ones in Illinois, Georgia and other states. The tracks made by the landing roll herein under investigation were the only example seen in which they could be traced clear back to initial impact marks that appeared to be connected with them.

A careful visual study of the wheel marks made by the flight disclosed that they consisted of a dusting of loosely attached sandy material, decidedly lighter in color than the runway surface. Rubbing with the fingers removed this loose sandy material and restored the original appearance of the runway surface. Except for these particular wheel tracks, the entire runway surface was free from any sand or dust.

The runways at this airport seem to be made up of light-colored sand plus quartz or granite gravel plus a binder of asphalt-like material. It appears, therefore, that a localized washing by turbulent water under high pressure could remove most of the binding material from particles of sand on the surface. If the passage of the tire over the surface under certain conditions of water flooding produced such pressure and turbulence, it could produce the wheel marks that were observed. It seems reasonable to suppose that aircraft wheels (rolling or locked) can and sometimes do "hydroplane" over a film of water on a paved runway which is in a drenched condition. Such "hydroplaning" conceivably could cause the washing just mentioned. The same conditions, high water pressure and turbulence, could account for tracks of similar appearance made on concrete by aircraft in the act of over-running the runway. In this case the accumulated discoloration caused by age and traffic could be washed from the porous surface of the concrete. This would duplicate the appearance of the above described tracks in everything except the loosely attached particles of sand. If this could be established by test data, the white-appearing wheel marks noted in this and other cases could be considered conclusive evidence that the tires were "hydroplaning" and that the brakes were ineffective even though they may be found to be in perfect mechanical condition.

Test data might produce knowledge which would permit "hydroplaning" to be anticipated. Conceivably, "hydroplaning" might be possible only when some particular relationship exists, such as some definite ratio of tire air pressure to total load, or speed to depth of water film, etc.

It should be noted that once this "hydroplaning" starts it continues until the movement stops or the conditions (other than speed) change, as when the wheels leave the pavement. This would seem to indicate that speed in itself is not the controlling condition.

Accidents such as this have caused the loss of many lives and of many aircraft. Reducing these losses should be ample repayment for the cost of a lot of research work.

COMMENTS:

1. New techniques for landing on wet runways are under development, especially in regard to use of the control wheel for applying load on the main gear.
2. The tendency to land too far down the runway can be counteracted by better marking of the threshold.

PITFALLS

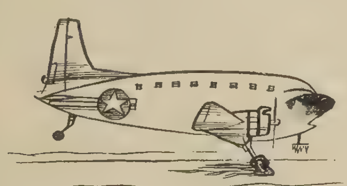
by Jerome Lederer and Robert Osborn

3. The amber-colored lights which are used to indicate the last 1500 feet of runway should be more distinctive than they are at the present time.

COLD IN THE HEAD

The other day a C-47 aborted a take-off due to frozen airspeed heads. The airplane had been flown to the airport on a Friday afternoon; the airspeed heads were properly covered and the airplane remained parked on the field from Friday until the following Monday morning. Each night of the stay freezing conditions prevailed.

Upon returning to the field from the aborted take-off, pitot heat was applied externally to the head and the airspeed indicator responded. The head on this C-47 was the standard one used on all C-47's and DC-3's, and regulations usually state that pitot heat should not be used until the airplane is airborne, to prevent overheating. Some airlines and other operators of C-47's and DC-3's require the application of pitot heat at low outside temperatures before leaving the line. Certainly, good operation pre-flight requires a hand check of the pitot tube to see that heat will be available.



The pilot who reported the above incident stated: "I am not convinced that atmospheric humidity and breathing of the tube could condense sufficient water to block any passage. However, perhaps the drain holes were dirty and plugged by metal polish or other debris."

"I do believe further," he added, "that more attention should be given to checking airspeed heads before take-off, because a take-off into a low overcast with poor visibility and without a primary flight instrument could have been hazardous. To sum up, we had a frozen airspeed head and we did not sufficiently check it before take-off."

ALTIMETER SETTINGS

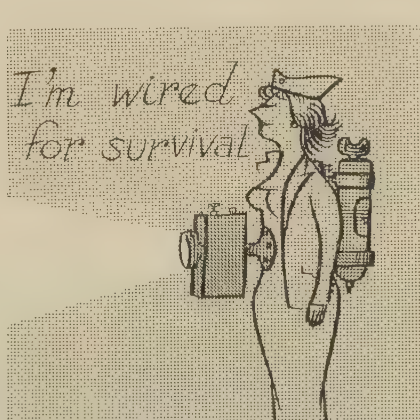
Not to be outdone, the USAF's *Flying Safety* magazine comes up with a word of caution that stands repeating:

"Remember, the altimeter will read too high when the airplane is flying from higher toward lower pressures. Flights into cold air will also have an effect on the altimeter. Since there is a rumor that some snow clouds consist primarily of mountain peaks, the altimeter error had best be planned for in advance."

NIGHT CRASHES

Accidents that occur at night create greater survival problems than those that happen during daylight hours. One reason for this is the loss of cabin light in the event of a crash. A solution offered by one airline is to require that the emergency lights (of considerable size and independently powered by a battery) be turned on by the cabin attendant prior to every night landing and take-off. Incidentally, the brackets holding these lights should be designed for about 12 g's.

In fact, all brackets should be designed with this strength. In one case of an unexpected crash landing, the bracket holding the fire extinguisher broke and the fire extinguisher rolled under the instrument panel. In a crash landing, the emergency duty of the copilot calls for him to grab the extinguisher and make fast tracks out the cabin exit to a point at the wing root where he will be in a position to attack any fire that may start there. If the fire extinguisher breaks lose in survivable type accidents, it may not be available for use in such fire emergencies.



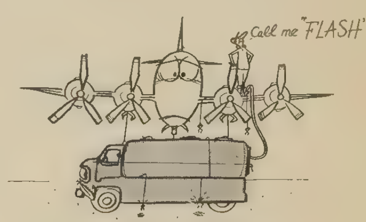
And then there is also the case of the fire extinguisher in the cabin that broke lose in a crash and caused serious head injuries to the stewardess.

Use those lights and check t h o s e brackets. There's no point in adding injury to insult.

MUTUAL MONITORING

A recent incident of a new First Officer mis-setting his altimeter and the flight holding at a wrong altitude focuses attention on the need for constant continuous altimeter setting *monitoring* by *all* crew members. Altimeter control procedure was born of much bitter experience.

It is best that we all profit from our mistakes. Mutual *monitoring* is one answer to a large segment of our safety problems.



$1,000,000 LOSS—STATIC

There's more to static than noise, and proof of the potency of a static discharge comes in a recent report of a refueling accident involving the bugaboo, static discharge.

"Normally, four grounding wires are necessary: namely, aircraft to ground; refueling tender to ground, tender to aircraft, and nozzle to tank. In this incident, the airman put the nozzle into the tank, the gas started to run through, and after about three seconds, an explosion occurred. The airman was burned and blown off the wing, and the aircraft caught fire. Due to shock and burns, the airman remembered nothing of what had happened. It was snowing heavily at the time of the incident and the nozzle connecting wire was never found.

"The cause of the static discharge may have come from the airman himself, who had been walking about the wing clearing off snow and who was wearing rubber flying boots at the time."

SKYWAYS FOR BUSINESS

NEWS NOTES FOR PILOTS, PLANE OWNERS OPERATING AIRCRAFT IN THE INTEREST OF BUSINESS

EXECUTIVE VERSION *of the Viscount, like this one shown landing at the Wisley Airport in Surrey, England, is to be delivered to the President of India during the summer of 1955*

Executive Version of Viscount Being Readied for India Pres.

London, England. The first VIP version of the Vickers *Viscount* turboprop-powered transport will be delivered to the President of India in the summer of 1955, along with a second 40-passenger *Viscount* to be used by members of the Indian Government and senior Indian officials.

The President's *Viscount*, which also will be used by the Prime Minister, provides VIP accommodations for two people. A rest chamber, furnished with two beds, is located in the fore section of the plane and is separated by a bulkhead from a conference room which is equipped with a six-place table and a sofa. The aft compartment is an officials' lounge with seating for 10. Two toilets are fitted, one in the forward section and another in the aft section of the aircraft. The pantry has been re-positioned in the aft vestibule.

Known as the Type 730, this version of the *Viscount* and the 40-passenger one are powered by Rolls-Royce *Dart* engines which give the aircraft a cruising speed of more than 350 mph, with a maximum range (with reserve) of 1800 miles.

CAA Survey Shows Increase in Business, Industrial Flying

Washington, D.C. According to a survey recently completed by the CAA, business, agricultural and industrial flying increased during 1952, while instructional and pleasure flying dropped.

Business flying totaled some 3,124,000 hours, representing an increase of 6% over that of 1951. It is the leading form of non-airline flying, accounting for 38.2% of all general aviation activity in 1952. For the first time in a CAA survey, business flying was broken down between that done by companies, amounting to 2,125,000 hours, and that done by individuals—999,000 hours.

Commercial agricultural activities, *i.e.* dusting and spraying, numbered 707,000 hours, an increase in that category of 3.2%. Industrial flying, such as pipe-line patrol, surveying and aerial advertising, reached a total of 317,000 hours, indicating a gain of 31.5%.

New Portable Engine Heater Meets Winter Requirements

Milwaukee, Wis. A new lightweight portable kerosene-fired heater to meet winter aircraft-engine warming requirements has been brought out by Western Metal Specialty Company. The new heater employs the same principle of combustion as a blow torch to produce an intense, smokeless and sootless flame generating 75,000 btu per hour. Called "Hot Blast," the heater weighs 59 pounds and is available with wheels for easy moving over rough ground.

The heater also can be used to heat small hangars, repair shops and airport offices where temperatures can be raised from zero to 85° in less than an hour. A welded fuel tank of 10-gauge steel holds enough kerosene for nine hours continuous operation. A tank pressure of only 65 pounds is required for ignition, and the tank will withstand a pressure of more than 500 pounds. An automatic fuel shut-off control exhausts the air pressure in case of flame failure.

Aircraft Service Station Opened at Allegheny County Airport

Pittsburgh, Pa. Gulf Oil Corp. has announced the opening of the first service station to be designed exclusively for the fueling and lubrication of aircraft. Located at Allegheny County Airport, the new service station is built of porcelain enamel on concrete block and resembles its automobile counterpart in both style and size (35 ft. x 25 ft.). Operations-wise, however, the structure is uniquely designed to serve aviation. There are no gas pumps since all servicing is by mobile refuelers.

The major floor area of the station is taken up by a lounge and charting room for pilots and passengers. The lounge features a large air map on the wall, enabling flyers to figure routes and mileages, a table for plotting courses, leather couches and chairs, and a telephone.

Government reports on current weather conditions and periodic Government forecasts, received by teletype, are posted hourly. This is the only such weather information available at the airport. In the office a radio, tuned to the tower, gives advance notice of approaching aircraft.

Five trained, uniformed attendants are assigned to the station, and their only duties are to provide service to aircraft on a 24-hour basis. Courtesies such as windshield cleaning and sweeping of cockpit and cabin floors will be stressed.

At the present time, 28 twin-engine executive aircraft of the DC-3 and *Lodestar* type are based at Allegheny County Airport, and the field also is used by both scheduled and irregular freight service.

AERO SERVICE STATION, *built on familiar lines of automobile gas stations, has been placed in operation by the Gulf Oil Corporation at Allegheny County Airport, Pittsburgh*

Pratt & Whitney Completes New Hangar at Rentschler

East Hartford, Conn. Construction of a new, modern service hangar was completed recently at Rentschler Airport. Equipped to accommodate military and commercial aircraft as large as the AF's C-97, the new hangar is 40 ft. high, 168 ft. long and 152 ft. wide. The difficulty of servicing aircraft outdoors in the winter was a big factor in the decision to build the new hangar.

According to L. L. Snow, airport manager, one night of sleet and snow formerly made it impossible to prepare a plane for take-off on the following day. Now, however, a plane can be made ready for take-off on just 15 minutes notice.

Space has been provided in the hangar for a work shop where repair work can be done on plane parts. Plans also call for a shielded radio laboratory so that electronic equipment can be tested without interference from electronic devices used in the plant.

New Easy-to-Reach Tab Control Developed for the Lodestar

Lindenhurst, N.Y. Those *Lodestar* pilots who are tired on having to grope for the tab control will welcome an innovation devised by William Thornsen which lifts the tab control to an easy-to-handle position near the throttle. Constructed of dural and steel, the "extension" raises the tab control some 14 inches and places the palm-rotating tab wheel in a very accessible place. The new tab control is CAA approved, and is being marketed by Aircraftsmen, Inc., of Zahns Airport in Lindenhurst. Installation and cost of the new tab wheel control is $275. To date, an installation has been made on the Continental Can Company *Lodestar*, and one is in the process of installation on the Levitt Bros. *Lodestar*.

NEW TAB CONTROL *developed for Lodestar is located on pedestal near throttles*

....in the Business Hangar

The Charles B. Knox Gelatine Company is converting its Grumman *Widgeon* (G-44A) to the Lycoming 260-hp installation. The modification is being handled by Win-Air in Syracuse, N. Y.

Halliburton Oil Well Cementing Co. of Duncan, Oklahoma, has added an executive DC-3 to its fleet of business aircraft. The plane was completely rebuilt by Executive Aircraft Service, Inc., Dallas, and Wright R-1820 engines were installed. The DC-3's pilot is Paul Rider.

General Sheet Steel of Detroit has added a Flite-Tronics MB-3 marker beacon receiver and a CA-1 audio distribution amplifier to its *Aero Commander*. The installation was made by Gordon Air Service, Pontiac, Mich.

The B-25 belonging to Albert Trostel and Sons of Milwaukee has been in the shop at Southwest Airmotive for its regular 1,000-hour inspection. Chief Pilot and NBAA representative Tom Neyland and his copilot, Tom Gullickson, are at SAC with the plane.

Koppers Company DC-3 from Pittsburgh is back flying after installation of new Collins Integrated Flight System, 1,000-hour inspection, new paint job, installation of a 50,000 btu Janitrol heater in the rear fuselage and the Barber-Coleman automatic heater controls. The work was done by Aerodex at Miami. B. Q. VanCott is chief pilot for Koppers.

Goodyear Tire and Rubber Co. has had its *Lodestar* at AiResearch Aviation Service for installation of nylon fuel cells. These cells replace the integral tank system and eliminate the need for periodic resealing.

The *Mallard* owned by Sherman Marquette Company of Chicago has a new paint job. The work was done by Northwestern Aeronautical Co. at St. Paul. Pilot of the *Mallard* is Arthur Brennan.

John Lambert, chief pilot for U. S. Rubber Co., has had his company's DC-3 at Mallard Industries for installation of a glare shield panel with indirect lighting. The plane is based at Teterboro, N. J.

The de Havilland *Dove* owned by Admiral Corp., Chicago, has been equipped with Flite-Tronics MB-3 marker beacon receiver. Gordon Air Service, Pontiac, Mich., made the installation.

Tony Zuma, chief pilot for Tennessee Gas Transmission Co., Houston, Texas, has one of the company's DC-3's at Executive Aircraft Service, Dallas, for installation of a rudder incorporating a geared servo tab. Tony also is his company's NBAA representative.

Fairbanks, Morse Lockheed PV-1 is scheduled for installation of Aerodex specially modified propellers which increase initial sea level take-off thrust some 25%.

Ralph Matthews and the Sawhill Manufacturing Company's DC-3 stopped at Southwest Airmotive for line service work. Home base for the DC-3 is Sharon, Pa., and Ralph is his company's NBAA representative.

Fullerton Oil Company has equipped its B-26 business plane with a Flite-Tronics CA-20 cabin amplifier and an MB-3 marker beacon receiver. Installation was made by Grand Central Aircraft Co., Glendale, Calif.

Simmonds Aerocessories has been granted a CAA Repair Certificate covering the work SAI has undertaken in providing overhaul service for Hobson carburetor systems installed on de Havilland *Doves* now flying in the U. S. and Canada. Hobson carburetor systems must be overhauled and re-calibrated every 1100 hours.

Official NBAA Report

NATIONAL BUSINESS AIRCRAFT ASSOCIATION, INC.

(formerly Corporation Aircraft Owners Association)

National Business Aircraft Association, Inc. is a non-profit organization designed to promote the aviation interests of the member firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable business aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. NBAA National Headquarters are located at 1701 K Street, N. W. Suite 204, Washington 6, D.C. Phone: National 8-0804.

New Offices

At its meeting in Washington in December, the board of Directors of NBAA approved the moving of National Headquarters to new and larger offices. After January 15, 1954, the new address is:

National Business Aircraft Assn.
1701 K Street, N.W.—Suite 204
Washington 6, D.C.
Telephone: NAtional 8-0804

NBAA Board Chairman, Cole H. Morrow, in announcing the change of Association offices said: "The continued growth of NBAA requires an expansion of National Headquarters facilities and an enlargement of its staff. Our steady increase in members is proof to the Board that the services being performed by NBAA at the national level, in behalf of business aircraft owners and operators, is being more widely recognized and appreciated. All indications point to almost double our membership in 1954."

CAA and Military Renew Dispute Over DME System

The dispute between civil and military officials as to whether the CAA should abandon its present DME (distance measuring equipment) system for a newer military design may go to the President to be resolved.

The Commerce Department insists that the present civil DME is adequate and says it already has installed about half of the 450 DME stations planned, has equipment for the remainder and will install these when its work load permits.

If the CAA were compelled to adopt the newer military system, it probably would find it cheaper to scrap existing ground equipments than to modify them. Some civil users, mostly business aircraft owners, already are using DME and others have ordered airborne units.

Meanwhile, the airlines are not placing orders for civil DME airborne equipment because of the possibility that proponents of military DME may be able to force CAA to abandon its present civil system.

The first CAA-military dispute over DME arose about three years ago.

The ensuing debate helped to split the Air Navigation Development Board and the navigation committee of Defense's Research and Development Board, resulting in the civil and military following divergent paths.

The dispute has flared anew with recent attempts to re-wed civil and military to a "common system," in the interest of operating efficiency and budget economy. The outcome is anyone's guess.

NBAA strongly opposes the proposed plan to abandon the present DME system since the change will increase the cost, size, and complexity of airborne units over resent civil DME designs made by NARCO and Bendix/Hazeltine. In the military DME, closer channel spacing makes it mandatory to use crystal control and greater circuit complexity, thus increasing the cost.

Since business-aircraft operators, particularly NBAA members, afford a sizeable potential DME market, the scrapping of the existing civil system would seriously hamper its expanded use.

Outlook Bright for Continued Federal Operation of Towers

The impracticability of transferring the responsibility of air traffic control to local governments brightens the outlook for continued Federal operation of essential airport towers.

A study conducted by the Commerce Department to find out whether there was any way to divide the traffic-handling responsibilities between federal and local governments, found it impractical at the present time. Although it was considered possible to divide Federal-local control of visual and instrument flight conditions, the matter has been shelved until a future date.

NBAA has strongly opposed the closing of towers, particularly at cities where there is a heavy concentration of business aircraft. The Association also urged discarding the obsolete criteria used for posting air movements which discriminated against itinerant business aircraft. Latest reports indicate that the criteria now allows equal weight for all itinerant aircraft movements, thus eliminating the top-heavy airline "points" previously counted. The total minimum movements to be allowed for continuation of the Federal aid to local towers is to be decided in a forthcoming session of the ACC Air Navigation Development Board.

As a member of the Air Traffic Control and Navigation Panel, NBAA will continue to vigorously press for equitable action on this matter. Approval of the new criteria will place such important business aircraft centers as Westchester Airport, White Plains, New York, and Bridgeport, Conn., in the running for resumption of Federal funds for their airport towers. This will relieve the local authority and business-aircraft operators based on the airport of the burden of financing the tower operation.

Flight Plans Accepted by Some Highway Patrol Systems

Currently, the Highway Patrol systems of several States are cooperating with the CAA in the handling of flight plans filed by pilots in remote regions which are not reached by the CAA communications system. This service was first placed in effect in Colorado, in July 1951. Since that date, several other western States have adopted the plan, or have it under consideration. Briefly, in following this plan, State Police officers accept flight plan messages from pilots and relay them, via the police communications network, to designated CAA stations.

In view of the increased safety it affords to civil aviation, the CAA fosters this plan and favors its practice wherever it may be appropriate.

Where the plan exists, the CAA flight plan service is placed within reach of pilots in isolated areas. Although this is a convenience to the pilot, the primary purpose of the plan is to have flight plans on every possible aircraft flight, so that search and rescue procedures can be activated promptly if the pilot fails to reach his destination. CAA records have shown that each year many aircraft meet with accidents or disappear in remote areas of rugged terrain, such as mountains, forests or swamplands. Frequently, these aircraft are not on flight plans and some time elapses before search for them is started. In all such incidents, one of the first organizations to be alerted is the State Police. It then becomes their official responsibility to take an active part in the preliminary ground search, which includes checking airports and running down reports and rumors of aircraft sightings. This work consumes a large number of man-hours and involves extensive use of the police radio communications network. If a flight plan has been filed, the task of locating the aircraft, either safe or wrecked, is usually simplified.

In recent discussions between the CAA Los Angeles Regional Office and California State Police officials, a question was raised concerning the Federal Communications Commission attitude toward the handling of flight plan messages by State Highway Patrol radio stations. In following up this point, CAA was advised informally that FCC interpretation of licensing regulations may not favor the use of police radio

channels for that purpose. It is understood that some time ago the FCC denied a request from the Oklahoma State Police for permission to handle traffic of this type.

The CAA feels very strongly that this program is vitally needed in the interest of making aviation safer for pilots in isolated areas of the country. Information indicates that the volume of flight plan messages actually being handled by the participating State Police organizations does not impose any appreciable additional load on the radio frequencies in use.

Inasmuch as the use of FCC licensed radio stations is important in the successful operation of this plan, the CAA is seeking the official FCC attitude in relation thereto. The messages concerned in this plan appear to be closely associated with safety measures in which the police organizations have an interest, the CAA recommended that the FCC concept be broadened to permit transmission of flight plans on police radio frequencies to the limited extent required. If this is not feasible within present FCC regulations, it further recommended that action be initiated to amend the regulation so as to make possible the handling of such messages by these public service stations.

Tips on Winter Use of Aircraft in Northern U.S.

Winter flying in small business aircraft is safe and pleasant *if* you remember to "winterize" your aircraft and your flying habits. Here are some tips to guide business pilots in the northern part of the United States. There is still plenty of winter weather ahead of us, so the tips are of continued operational value.

1. Never take off with frost or snow on the wings or control surfaces. Even a small amount of frost changes the airflow and reduces lift. Often overlooked, but equally important, is cleaning frost from the propeller. The propeller, like the wings, is an airfoil, and any accumulation makes it less efficient. Covers for wings and control surfaces are inexpensive and effective in keeping surfaces clean and dry.

2. Using water to remove snow or frost is not a recommended practice. If you insist on using it, rub the surfaces dry and be sure no slush or water has accumulated around control edges or control cables. If the slush subsequently freezes, you may find yourself in a difficult predicament.

3. Examine the vent on the gas-tank cover as a routine part of the pre-flight check. Water frozen over the vent, or a particle of foreign matter in the vent, can stop the flow of gasoline to the carburetor.

4. The battery is less efficient in winter, and the strain on it greater. Use an auxiliary battery for starting in cold weather. Be sure your regular battery is in top condition.

5. Be kind to both engine and battery by diluting oil that is stiff from cold. Equally effective is using pre-heated oil.

6. It is common practice to "lag", or insulate, oil lines, oil reservoirs, and ducts carrying carburetor heat. Safe and effective methods differ in different aircraft. Consult an experienced mechanic. Some manufacturers list special winterizing equipment for their aircraft. Investigate this in regard to your particular aircraft.

7. Water condensation can be serious in cold weather. Fill your tanks before storage. Check all drain sumps and traps before take-off if the aircraft has stood unused for some time or has been exposed to rain, either on the ground or in the air.

8. Avoid icing conditions as you would the plague. It takes only a little ice on the windshield to cut visibility to zero. If your aircraft is so constructed that you can reach the outside of the windshield in flight, carry a bottle of glycerin and alcohol. If you run into ice accidently, it might give you enough outside vision to land safely.

9. Never forget that carburetor heat is more important in above-freezing temperatures than it is when the air is very cold. Carburetors can ice with high outside temperatures—it's the moisture in the air that counts.

10. Restrain your impatience to take off until your engine and oil are warmed to a point where it is safe to "let her roll."

NBAA Member Issues Own Company Plane Publication

NBAA Member, Chief Pilot Richard "Dick" W. Lane, of Food Machinery and Chemical Co., San Jose, California, has compiled and issued a most interesting "Airnews" publication to company officials to help them keep abreast of the activities of their Air Transportation Department.

Said Lane in the first issue, "A modern industrial concern, like ours, is much like a military organization. It can rise and fall on its line of communications. Time and timing are important. Time spent in traveling is often wasted time. Time wasted is money lost."

Lane went on to discuss the phenomenal growth of business flying and what aircraft have meant to the company. Included was a biography of the pilots that fly the company planes.

Copies of "Airnews" are available upon request. The value of such an informative inter-organization aviation publication cannot be underestimated. Keeping the "bosses" well-informed of the utility of their aircraft and of new developments in business flying is a highly worthwhile service.

New NBAA Members

1. Aero Associates, Inc., Chicago, Ill. NBAA Representative—E. C. Sutton, Safety Engineer; Company operates Cessna 170
2. Allegheny Ludlum Steel Corp., Pittsburgh, Pa. NBAA Representative—Lloyd C. Santmyer, Chief Pilot; Company operates Lockheed *Lodestar*
3. Aluminum Company of America, Pittsburgh, Pa. NBAA Representative—David L. Flannery, Chief Pilot; Company operates DC-3 and Beechcraft D18S
4. Anheuser-Busch, Inc., St. Louis, Mo. NBAA Representative—Walter J. Westerfield, Pilot; Company operates DC-3.
5. The Bristol Brass Corp., Bristol, Conn. NBAA Representative—Charles F. Harmon, Jr., Chief Pilot; Company operates Riley *Twin-Navion*
6. Executive Aircraft Service, Inc., Dallas, Texas. NBAA Representative—L. V. Emery, Pres.
7. Gamble-Skogmo, Inc., Minneapolis, Minn. NBAA Representative—Donald L. Stimson, Chief Pilot; Company operates Lockheed *Lodsetar*
8. Hiller Helicopter Sales, Chicago, Ill. NBAA Representative—Robert M. Boughton, Chief Pilot; Company operates 12-B helicopters.
9. Robert Hewitt Associates, New York, New York. NBAA Representative—D. A. Peterson, V.P.
10. Jones and Laughlin Steel Corp., Pittsburgh, Pa. NBAA Representative—Charles E. Paul, Chief Pilot; Company operates Douglas Lockheed *Lodestar* 18
11. Koppers Company, Inc., Pittsburgh, Pa. NBAA Representative—Byron Q. Van Cott, Chief Pilot; Company operates Douglas DC-3.
12. Lamb Aviation, East Hamton, Long Island, New York. NBAA Representative —Mel Lamb, Pres.
13. Melpar, Inc., Alexandria, Va. NBAA Representative—Ralph I. Cole, Staff Asst.
14. Mellon National Bank and Trust Co., Pittsburgh, Pa. NBAA Representative—Roy C. Weiland, Chief Pilot; Company operates Lockheed *Lodestar*
15. Mesta Machine Co., Pittsburgh, Pa. NBAA Representative—A. Litzenberger, Pilot; Company Operates Douglas A-26
16. Riegel Textile Corp., New York, New York. NBAA Representative—William A. Crawford, Chief Pilot; Company operates Twin Beechcraft D18S
17. Page Airways, Inc., Rochester, N. Y. NBAA Representative—Douglas W. Juston, Chief Pilot; Company operates Lockheed *Lodestar*, Beechcraft D18S, Beech *Bonanza*
18. Pepsi-Cola Company, New York, New York, L. I. NBAA Representative—L. L. Moseley, Pilot; Company Operates Lockheed *Lodestar* 18
19. Petrolite Corporation, St. Louis, Mo. NBAA Representative—J. Robert Burrell, Chief Pilot; Company Operates Beech 50, Beech C-35, Beech A-35, Cessna 170
20. Pittsburgh Plate Glass Co., Pittsburgh, Pa. NBAA Representative—C. E. Newton, Chief Pilot; Company Operates Douglas DC-3.
21. The Pulitzer Publishing Company, St. Louis, Mo. NBAA Representative—John V. Matthews, Chief Pilot; Company operates Douglas DC-3.
22. Rea Magnet Wire Co., Inc. Ft. Wayne, Indiana. NBAA Representative—Raymond A. Wrisley, Chief Pilot; Company operates *Aero Commander*
23. United States Aviation Underwriters, Inc., Chicago, Ill. NBAA Representative—James R. Graham; Company operates Cessna 170
24. Walsh Construction Co., New York, New York, NBAA Representative—Fred M. Leslie, Chief Pilot; Company operates Lockheed *Lodestar*
25. Westinghouse Electric Corp., Pittsburgh, Pa. NBAA Representative—A. C. Korb, Chief Pilot; Company operates Lockheed Model 18

What about this new DC-7?

Rack of Collins equipment in the new DC-7. Equipment that guides the big plane on cross country flying, leads it unerringly to precise instrument landings, provides dependable contact with ground stations at all times.

Sixty passengers can board the DC-7 and travel in air-conditioned comfort non-stop from coast to coast . . . in only 8 hours.

How fast is it? The fastest piston-powered airliner in the world. Cruising speed 365 mph. Top speed 400 mph. It takes you non-stop from New York to Los Angeles in just 8 hours. The power comes from four turbo-compound engines which generate a total of 13,000 horsepower.

What's it like inside? Luxurious and big. It seats 60 in air-conditioned comfort. With additional lounge space in the rear. The buffet can handle 72 complete meals and snack service. Cargo capacity: 13,980 lbs.

What kind of flight and radio equipment? Collins! Here's a typical installation of Collins equipment in the fabulous new DC-7: two 51V Glide Slope Receivers, two 51R-3 Navigation Receivers, one 351 VOR accessory unit and a 37J VOR antenna for dual ILS and Omni reception; the Collins 51R Receiver and 37R Antenna for VHF communications; the 18S Transceiver and 180 K Antenna Tuning Unit for HF communications; Omni Bearing Selectors for dual RMI instrumentation . . . all Collins.

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Navigation NAVICOM Communication

Channeled Flow of Traffic N.Y. to Washington Means Better Use of the Airspace

The Washington office of the CAA has advised that to provide more efficient utilization of the airspace along the airways serving the two major terminal areas—New York and Washington, a certain channeled flow of traffic is necessary. For the benefit of pilots filing flight plans IFR entirely or partially via these airways, it is useful to know that, regardless of weather conditions, IFR traffic between New York and Washington will be cleared in accordance with the routings and altitudes described.

Therefore, in order to avoid the common experience of filing and planning flight according to one route and then obtaining an ATC clearance via another route when at the end of the runway ready for take-off, consideration should be given to the following:

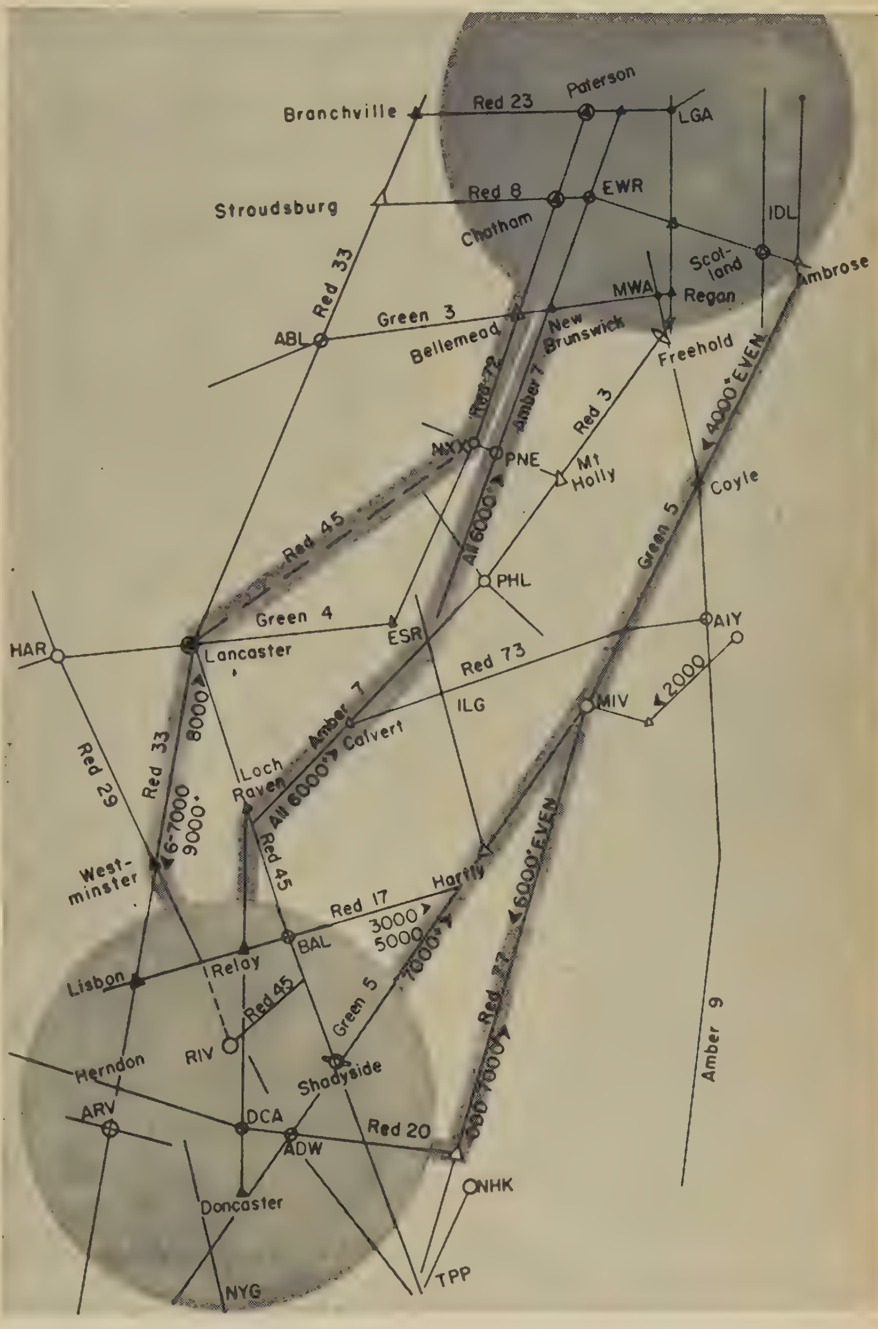
Northbound

Northbound traffic via Green Airways #5 will be cleared at *odd* altitudes beginning with 7,000 ft. and above. (*Note*: 3,000 and 5,000 ft. will normally be used for local traffic crossing beneath, *i.e.*, Baltimore to Atlantic City, or traffic detouring from Amber 7 to Green 5 to get a lower altitude passing the New York area than is possible on Amber 7.)

Aircraft enroute to Idlewild will be cleared via Green 5, Ambrose direct to Scotland intersection, direct Idlewild.

Aircraft enroute Newark and Teterboro will be cleared via Green 5 to Millville, Blue 20 to Philadelphia, Amber 7.

Aircraft enroute to LaGuardia will be cleared via Green 5 to Coyle intersection, Amber 9 to Regan intersection, Green 3 to LaGuardia.



Northbound traffic via Amber 7 will be cleared at 6,000 and above, all altitudes to 12,000 ft. (*Note*: Standard *odd* altitudes for direction of flight will be used from 13,000 ft. up for traffic enroute over the New York area, as to Hartford and Boston. And 5,000 ft. reserved for traffic northbound into Philadelphia.

Aircraft enroute Newark and Teterboro via Amber 7, New Brunswick direct Newark ILS Outer Marker, or via Newark LF Range and Newark Radar vector to Teterboro ILS.

Aircraft enroute Idlewild via Amber 7 Philadelphia, Red 3 Freehold, Blue 18 Red Bank, Idlewild.

Aircraft enroute LaGuardia via Amber 7 Philadelphia, Red 3 Regan, Green 3.

Northbound traffic via Red 77 out of Washington area at 7,000 and above, all *odd* altitudes; reserving 3,000 and 5,000 ft. for local traffic between Chesapeake Bay area and south Jersey points.

Northbound aircraft via Red 29, Red 33 to Harrisburg, Reading and Allentown will normally be cleared via Red 29, Red 33 at 5,000 ft. and over; traffic to New York area at 8,000 ft.; reserving 4,000 ft. for low-altitude control of Harrisburg to Philadelphia, Baltimore and intermediate points traffic.

(*Continued on page 32*)

Channeled Flow of Traffic N.Y. to Washington Means Better Use of the Airspace

(Continued from page 31)

Southbound

Southbound traffic via Green 5 normally will be cleared as far as Andrews at *even* altitudes of 4,000 ft. and above, then direct to Washington Airport; reserving 2,000 ft. for local traffic and crossing traffic enroute Baltimore. (*Note*: Aircraft enroute beyond Washington area will be cleared at 10,000 ft. and above on this route.)

Southbound aircraft via Red 77, Millville to Richmond at or above 8,000 ft. enroute beyond Richmond. Washington area traffic at *even* altitudes of 6,000 ft. and above; 4,000 ft. reserved for local traffic in Chesapeake Bay area.

Southbound aircraft via Red 33 and Red 29, Allentown, Lancaster, Westminster, Ellicott City direct Riverdale, Amber 7 to Washington, at 6,000 to 7,000, 9,000 through 12,000 ft., reserving 8,000 ft. and lower altitudes for northbound traffic. Baltimore traffic is cleared via Red 33 and Red 20 to Relay intersection; Red 45 not being normally used for this purpose. Aircraft enroute beyond the Washington area on Red 33 may expect *even* alitudes at or above 10,000 ft. via Herndon.

In conclusion, aircraft requesting deviations from the foregoing will be subject to the density of traffic flow at the time. Obviously, weather and flight conditions conducive to easily attained "5 on top" altitudes will expedite other routings.

Second ILS Commissioned at Greater Pittsburgh

For the present, an unusual situation exists at the Greater Pittsburgh Airport. Two ILS systems are commissioned, although the second lacks a glide path at this time.

Caution is recommended to pilots planning ILS approaches in that the approved ILS approach procedure pertains to the system on 110.3 mc serving Runway 32 (Identification: "PIT") with compass locator on 201 kc at the Outer Marker only.

The second ILS system is on 109.7 mc, serves Runway 28, identifies "GPB", and has no glide path. The Outer Marker Comlo is the Greater Pittsburgh radio beacon on 323 kc, "GRP," 6.5 miles from the end of Runway 28. The Middle Marker Comlo is the Parkway radio beacon on 302 kc ("GMM") .7 miles from the end of Runway 28.

Unless the Approach Controller specifies approach to Runway 28, it should be assumed that the approved Runway 32 ILS is intended. This may change at any date, so a check with ATC is in order. While, for the time being, Runway 28-10 is frequently closed, when the installation is completed, it probably will become the designated ILS approach with back course over the Clinton radio beacon.

Coincidently, the ASR-2 Radar should be commissioned by now and the property problem for the centerline approach light system resolved, so that construction can proceed when funds permit.

Of additional interest in the Pittsburgh area is the swinging of the NE and SW courses of the PIT LF range to 224° and 44° respectively inbound toward the station. Concurrently, the Cecil, New Alexandria and Armagh VHF markers are being decommissioned, practically making Green Airway 4 an ADF airway as far as the New Alexandria radio beacon.

Air-Aids Spotlight

AKRON, Ohio: *LF range may be saved by lowering antennas (virtually right on airport), improving landing minimums. SE course to be realigned to 290° inbound, and NW course 110° inbound.*

ATLANTA, Ga: *VOR commissioned on 117.6 mc ("ATL") located 9.3 miles, bearing 017°, from VOR to airport.*

BRADFORD, Pa.: *DME commissioned, frequency paired with VOR on 114.4 mc located approximately at same site as present LF radio beacon.*

DENVER, Col.: *ILS system decommissioned on Runway 21 and realigned with Runway 26L.*

HUNTINGTON, W. Va.: *Four-course LF range changed to BMH radio beacon on same frequency. VHF Z-marker decommissioned.*

PROVIDENCE, R. I.: *ILS commissioned on 109.3 mc serving Runway 5R, ident. "PVD". Glide slope commissioned, altitudes over OM and MM to be announced; freq. 332 mc. LOM on 368 kc located 6.17 miles and MM .64 miles from end of runway.*

ST. LOUIS, Mo.: *New MHW radio beacon on 385 kc, identification "LAQ," located on back course of ILS 4.42 miles from approach end of Runway 6.*

WHEELING, W. Va.: *LOM approach cancellation with change to MHW facility, despite commissioning of ILS on 109.9 mc, leaves Wheeling with VOR approach only, for the present.*

WILLOW RUN, Mich.: *Radar Arrival Control will be provided by Approach Control to aircraft enroute to both Willow Run and Wayne Major airports (Detroit) IFR.*

RTCA Committee Makes Plea for Radar Beacons

For some time now, in fact since the end of World War II, civil aviation in the United States has been hampered by one of the least understandable stumbling blocks to ultimate 100% usage of the airways and airspace. Since 1946, civilian GCA (Airport Surveillance and Precision Approach Radar) has been undergoing rapid installation throughout the country; VOR (Visual Omnidirectional Range) has almost completely blanketed the country; the hundreds of thousands of dollars and development man-hours spent on DME (Distance Measuring Equipment) is just beginning to bear fruit; all VHF (virtually free of atmospheric interference) communications is almost 100% accomplished; and numerous other worthy objectives are being won or their victory is in sight.

But in the field of Radar, probably the greatest potential traffic control tool of them all, all operations are based almost entirely *upon the circumstances of coincidence.* The pilot reports his estimated or computed position over a radio fix, the radar operator observes a target there coincidently with the report. And for all practical operational purposes, identification upon which further separation from traffic will be based, *is assumed!* Before any ex-GI experts shout "foul," let me point out that the time-honored *and time-consuming* practice of executing a lengthy series of identifying turns is definitely and properly out in the modern scheme of high-density IFR operations.

Pilot reports of estimated positions *and heading* are also used to "identify" aircraft and, because of the generally high navigational ability of most pilots operating in IFR conditions, few mis-

identifications result from the obvious effects of unknown wind conditions, even when *heading* and *track* have little similarity. Should an aircraft with which no contact has been made appear on the scope simultaneously with *coincident* position and track although possibly at a different altitude, only the subsequent development of the aircraft's movements will reveal the error.

Likewise, after take-off it is only the knowledge of the *coincident* take-off that identifies the target that appears on the scope along the projection of the runway line. In some locations, confusion has resulted from the fact that aircraft from adjacent airports often pass over at high altitude unbeknown to the airport concerned until observed on the screen. Radar operators have had many tense moments as a result of such incidents. Only when the area of supposed conflict lies within the scan of the Precision Radar equipment so that altitude measurements can be made is assurance obtained that the target observed *is* or *is not* the aircraft it is supposed to represent.

Despite all this, the fact is that, because of the high calibre and efficiency of both pilots and radar controllers plus various technique of employing old-fashioned methods of separation as additional precaution with the inevitable delay penalties, few incidents involving radar misidentification have occurred or ended unhappily. The sad fact is that, as with VHF DF, airborne radar beacons for identification purposes seem to be available only to the military. Conceding the facts of life that maybe the military have properly the first call on the production lines and that the military version is necessarily designed primarily for military usage, it seems that since "ex-GI" GCA equipment sufficed for the early postwar civilian activities, and many other instances of conversion to "civvies" helped the peacetime industry get rolling, radar transponders might also have been released to the public market by now.

Additionally, it would seem to be more urgent to have invested in faster development of a suitable civilian radar "safety" beacon as the Radio Technical Commission for Aeronautics calls it in their report, for the full employment of CAA radar facilities rather than to give the greatest emphasis to DME, worthy but only an improved method to replace "positioning" technique still doing the job quite adequately.

As RTCA points out, use of the "Radar Safety" Beacon (the use of the terms "safety" should eliminate all question of its priority) offers three principal advantages:

1. Improved reliability of the radar traffic control system.
2. Positive identification of aircraft by use of coded replies.
3. Faster movement of traffic due to closer separation intervals.

Possibly a more important "safety" advantage is that radar beacon reflections are receivable at distances and under weather conditions which render ordinary aircraft targets impossible to see.

Primary ground radar transmits pulse signals which reflect from aircraft as "echoes." Only a small part of the energy of the original signal is reflected, however, and a very weak signal is returned to the ground equipment. Under adverse conditions, these weak signals can be absorbed in the atmosphere to such a degree that no usable reflection is received, or the signals are so weak they are lost among returns from moderate to heavy precipitation.

In the secondary or beacon system, the ground signal "triggers" equipment in the airplane which transmits a reply pulse signal many times stronger than an "echo." In addition, these replies may be coded to provide aircraft identification as desired by ground radar controllers. Although the number of such different coded replies is limited, it is highly adequate for the normal requirements of terminal radar control, since it is not necessary for a pilot to leave his equipment continuously transmitting but only to key it when and as requested by the ground controller.

Coded replies by the beacon assure rapid, positive identification of aircraft upon entering the congested area and re-identification when continuity of tracking has been lost temporarily due to merger with other targets as in a holding pattern, fading in a "blind" spot or temporary outage of equipment. It might well eliminate both the "blind" spot factor and targets lost in precipitation. Closer separation intervals of aircraft attain faster movement of all traffic, which lessens congestion, and provide more efficient utilization of the airspace and the airport runways. It can operate at ranges up to 225 miles and altitudes above 60,000 feet, with continuous tracking up to within one mile of the ground transmitter, and it can key up to 10 different replies. Weight and cost should not exceed that of Distance Measuring Equipment and could be less. But—when?

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(picture presentation)

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Douglas DC-7

(Continued from page 11)

provide as good a control of cockpit temperature as is desired.

Speed Brake: From the pilot's standpoint, one of the most unique features of the DC-7 is the addition of a speed brake which can be used to reduce aircraft forward speed and/or increase rate of descent. Means have been provided to permit dropping the main gear at speeds up to 260 knots (226 mph). This is accomplished by operating a simple lever conveniently located in the cockpit. The speed brake is very effective in slowing the aircraft down to the speed where wing flaps and nose gear may be lowered. It will also be very effective as a safety device which can be used for emergency descents and for reducing aircraft forward speed when turbulent weather conditions are encountered.

Instrument Electrical System: All flight instruments operate from 115V AC normally supplied by two electrically driven inverters. This improves instrument reliability and simplifies the instrument electrical system by eliminating step-down transformers.

An emergency instrument electrical system is provided by a battery-driven inverter which will supply all flight instruments and one VOR communications receiver, or by two engine-driven alternators either of which can supply all flight instruments. These improvements to the instrument electrical system have made it possible to delete the entire standby vacuum instrument system and engine-driven vacuum pumps.

Flight panel instrument arrangement is nearly identical to that on the American Airlines DC-6. The Bendix RMI is now used as a primary direction indicator. A natural blue background for the gyro horizon has been added. The use of a blue background is not new, but has received much favorable comment from pilots who have flown with this instrument. It should do much to eliminate the monotony of the all-black instruments.

Airfoil and Cabin Heaters: Altitude reliability of wing, airfoil and cabin heaters has been improved through the use of dual ignition, rather than using one ignition system as a standby as was done on DC-6 aircraft. This has already proved effective in eliminating altitude blow-outs up to 30,000 ft.

Plenum chambers have been added to the common cabin supercharger and airfoil heater air inlets in the wing leading edge. These have proved successful in preventing snow blockage, which occurred in rare cases on DC-6 aircraft. The plenum chambers are heated by hot air from the airfoil anti-icing system. Plenum-chamber drains are provided and electrically heated.

Carburetor Preheat System: The alternate air system takes air from a flush scoop on top of the conventional carburetor ram air inlet scoop. Alternate air passes through a plenum chamber before entering the carburetor. Ram recovery of the alternate air system is less than expected. Even so, further means for improving ram recovery are being investigated.

Engine Fire Detection: The engines and nacelles are equipped with a dual Walter Kidde continuous element fire-detection system. This system gives more complete coverage than heretofore.

Brakes: Wheel brakes have comparatively higher energy absorption than previous aircraft, and pilots will notice the lighter pedal forces which give better "feel" as well as provide a noticeably more powerful brake. Experience to date has not indicated that this brake will result in more tire wear through skidding, although it might be expected. Heat dissipation is expected to be more critical because of the submerged brake disc installation.

Reverse Throttle Lock: A simple manually operated lock, convenient to both pilots, has been installed to prevent inadvertent movement of the throttles into reverse-thrust range. The installation permits removal of the electrically actuated lock used on DC-6 series aircraft. Although this manual lock, or sequence gate as it is sometimes called, requires an additional hand movement by the pilot to unlock the throttles, reversing has actually been made easier. Because of the more positive nature of the lock, spring detent loads have been reduced, thus decreasing throttle loads going into and coming out of reverse. Net result is that reversing is made easier and is now under the pilot's direct control.

The mechanics of the lock are simply arranged so that movement of any throttle into the forward-thrust range automatically locks that throttle, preventing it from going back into reverse until the lock is unlocked by the pilot. The throttles must be at forward idle in order to unlock the throttles to get into reverse.

Cockpit Arrangement: As the cockpit photo shows, instrument panel and control layout is as nearly identical to the DC-6 as possible. This maintains cockpit standardization between all American Airlines DC-6 and DC-7 type aircraft. The only changes which have been made are those logically required by the addition of new systems or new instrumentation. There are no major differences, we believe, in control arrangement, instrument-panel layout or aircraft systems which might cause confusion in changing back and forth between DC-6 and DC-7 aircraft.

The photograph shows the new speed brake handle located on the pedestal between the first officer's throttles and the propeller control selector box. Immediately below and aft of the propeller selector box is the bar for unlocking the throttles for reverse-thrust operation. Not shown in the photograph are the engine blower shift controls which are located on the forward side of the pedestal between the fuel selector and fuel cross-feed controls. These replace the convenient blower control switches used on the DC-6's. While there are, perhaps, advantages in having mechanically actuated blower shift controls, it does not seem warranted, both from a cockpit standardization standpoint and in view of the necessity to locate them in the somewhat cramped quarters.

The Freon system is controlled by a single On-Off switch conveniently located adjacent to the expansion turbine switch, thus keeping both cooling control switches together in the cockpit.

Basic flight instrument panel arrangement is identical to that used on American's DC-6 type aircraft. The Bendix RMI, which is used as a primary direction indicator, permits elimination of one instrument and makes for better instrument grouping. A Mach airspeed indicator provides a continuous indication of both actual indicated airspeed and the maximum airspeed at which the airplane should be flown.

Both red and white cockpit lighting are retained on the DC-7. There are still small shadows on the instrument panel from fire extinguisher selector valve handles and the air brake control handle, but this condition is being improved on later model DC-6B and DC-7 aircraft. Improvements are also being made in the lighting of the overhead panel and pedestal even though lighting is quite good now.

The Sperry A-12 electronic autopilot with approach coupler is installed in American Airline's long-range aircraft. The DC-7 also utilizes both Collins and Bendix radio equipment.

(Continued on page 38)

FIGURE 1—*Comparison of engine power and fuel consumption is shown in this Wright chart*

		Cylinder Power (HP)	Uncompounded Engine SFC	Turbo-Compound Total Power (HP)	Turbo Compounded SFC
Take-off		2775	.79	3250	.69
METO—(Low Blower)		2280	.728	2650	.636
Maximum Cruise	Low Blower	1680	.442	1910	.427
	High Blower	1510	.432	1800	.386

FIGURE 2—*Chart shows increased operating weight. Empty operating weight is 70,600 lbs.*

Aircraft Type	Zero Fuel-Oil Weight (lbs)	Landing Weight (lbs)	Take-off Weight (lbs) With Auto-Feathering	Take-off Weight (lbs) Windmilling Propellers
Long Range	88,350	95,000	122,000	114,600
Long Range	90.250	97,000	122,000	114,600
Short Range	88,350	95,000	116,800	114,600

Douglas DC-7

(Continued from page 36)

Carburetor Preheat Controls: The function of the carburetor heat control has been revised to utilize the alternate air source. In the full Down position cold "ram" air is supplied to the carburetor. Moving the handle up to the mid-position supplies air to the carburetor through the alternate air inlet scoop. Further movement of the control toward the hot position mixes hot air with ambient air from the alternate air scoop. Two different air doors are actuated by a single control to obtain this sequence of operation, and this has resulted in control handle loads considerably higher than on the DC-6 aircraft between the ram and alternate positions. Handle loads have been measured as high as 40 lbs in this range. In the preheat range, however, loads are more linear and are comparable to the DC-6.

Performance

Minor refinements in flight controls make the DC-7 "feel" like a DC-6, but flying qualities are slightly improved.

Rudder pedal control forces have been reduced through a reduction in the spring preload of the rudder tab. This makes for easier control of the airplane with an engine out, a force of approximately 150 lbs being required under the most critical engine-out condition. Spring trim for directional (trim) control is adequate under the most critical engine-out conditions. More turns of the trim control wheel are required, however, to trim under these conditions than on previous models. Rudder buffeting is quite noticeable at slow speeds with an engine out when full rudder deflection is used. This can be overcome somewhat by slightly raising the wing on the side of the dead engine in favor of less rudder deflection.

A substantial improvement in aileron control has been accomplished by reducing wheel throw to 90°. Aileron tab link ratios were modified accordingly to keep wheel forces comparable to the DC-6 although they are slightly higher. The reduction in wheel throw gives much better and easier "one-hand" lateral control. Aileron centering is positive at all speeds. This all results in an airplane which appears to have much improved aileron control under all conditions. Rates of roll of 20° per second are available and with only one hand on the control wheel.

Aileron trim is accomplished through a direct control trim tab. The better centering on the DC-7 increases the "apparent" lateral stability. A slight buffeting of the aileron is noted when full deflection is applied at moderate speeds. This condition, however, is almost never encountered during normal airline maneuvering.

The result of a lighter rudder is most noticeable under normal flight conditions for small rudder deflections. The 90° wheel throw of the ailerons and the lighter rudder force result in a nicer flying plane.

Elevator control is essentially the same as on DC-6B aircraft. Elevator Stick force is in the neighborhood of 55 lbs per "G" at forward cg and 34 per "G" at aft cg. Static Stability at aft cg has been made slightly more positive. Elevator Stick forces at forward cg increase steadily while slowing down for landing, but drop off sharply at about flare-out speed. This condition is not normally considered desirable although one can become accustomed to it.

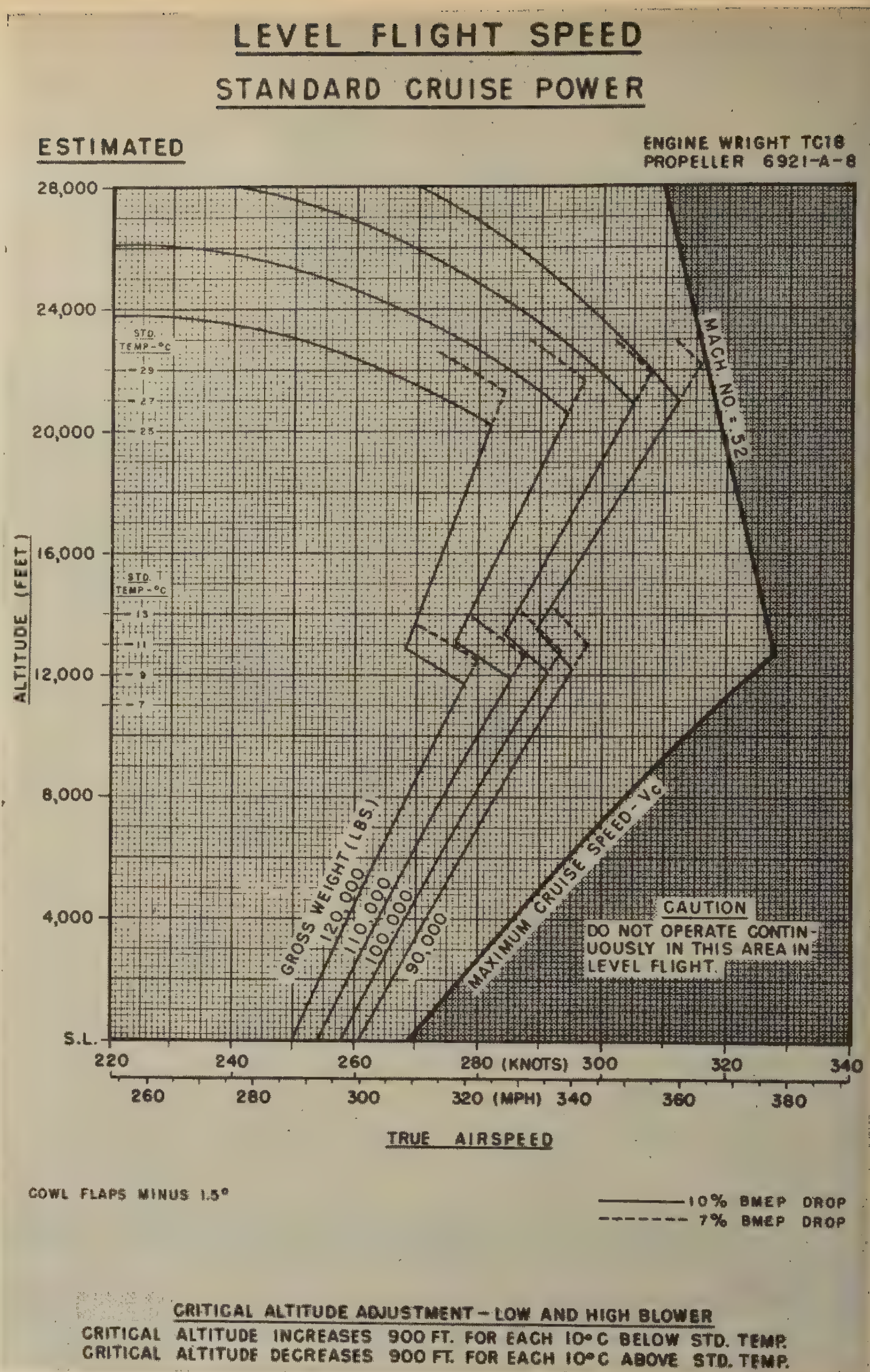


CHART 3

The Douglas Aerodynamics group has, as usual, hit cruise speed estimates right on the nose. Preliminary checks of cruising speed indicate that the actual speeds have almost met Douglas' speed estimates. Chart 3 reflects Douglas' estimated level-flight speed, but has been adjusted by American to reflect actual critical altitudes.

Take-off distances (Fig. 3) are shorter than Douglas predictions. Landing distances fall within guarantees. From this it can be seen that performance of the DC-7 has met nearly all expectations.

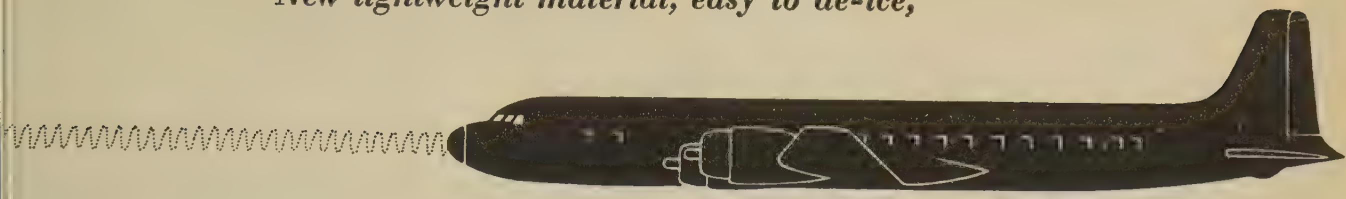
Critical engine failure speeds on the ground have been established on the basis of directional control with use of rudder alone. A minimum control speed on the ground of 95 knots (82 mph) establishes a minimum critical engine-failure speed for gross weights below 100,000 lbs.

The addition of a speed brake gives better control over descents (Chart 4). It also provides a means for slowing down the aircraft from high cruising descent to normal approach speeds. This permits higher cruise airspeeds during descent, when atmospheric conditions permit, or permits holding cruise altitude until closer to destination and then making a more rapid descent at lower airspeed.

Higher gross weights, higher wing loading and lower power loads have resulted in improved take-off climb performance.

(Continued on page 40)

New lightweight material, easy to de-ice,



protects radar instruments

without distorting the radar signal

Douglas "RADOME"

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Discovery of a better way to house radar is further proof of Douglas leadership in aviation. Light, tough Radome expresses a basic Douglas philosophy—*farther and faster with a bigger payload.*

Enlist to fly in the U. S. Air Force

Depend on *DOUGLAS* **First in Aviation**

Douglas DC-7

(Continued from page 38)

Rates of climb with an engine out are very impressive (see charts, page 11). Flight demonstrations at maximum gross weight, cutting an engine during take-off, verify these impressions.

While the DC-7 was being designed and built and even more recently, it has been said that this would be the last of the piston-engine aircraft. Next will come turboprops or turbojets. With the first DC-7 schedules having been barely inaugurated, there is already talk of improvements in this airplane and engine. Anticipation of future improvements in the turbo-compound engine could appreciably increase the cruising speed of the DC-7. Should this become a reality, perhaps the same will be said of the turbo-compound engine that is being said of radio with regards to TV—"the (piston engine) funeral has been postponed".

RATES OF DESCENT MAIN GEAR DOWN

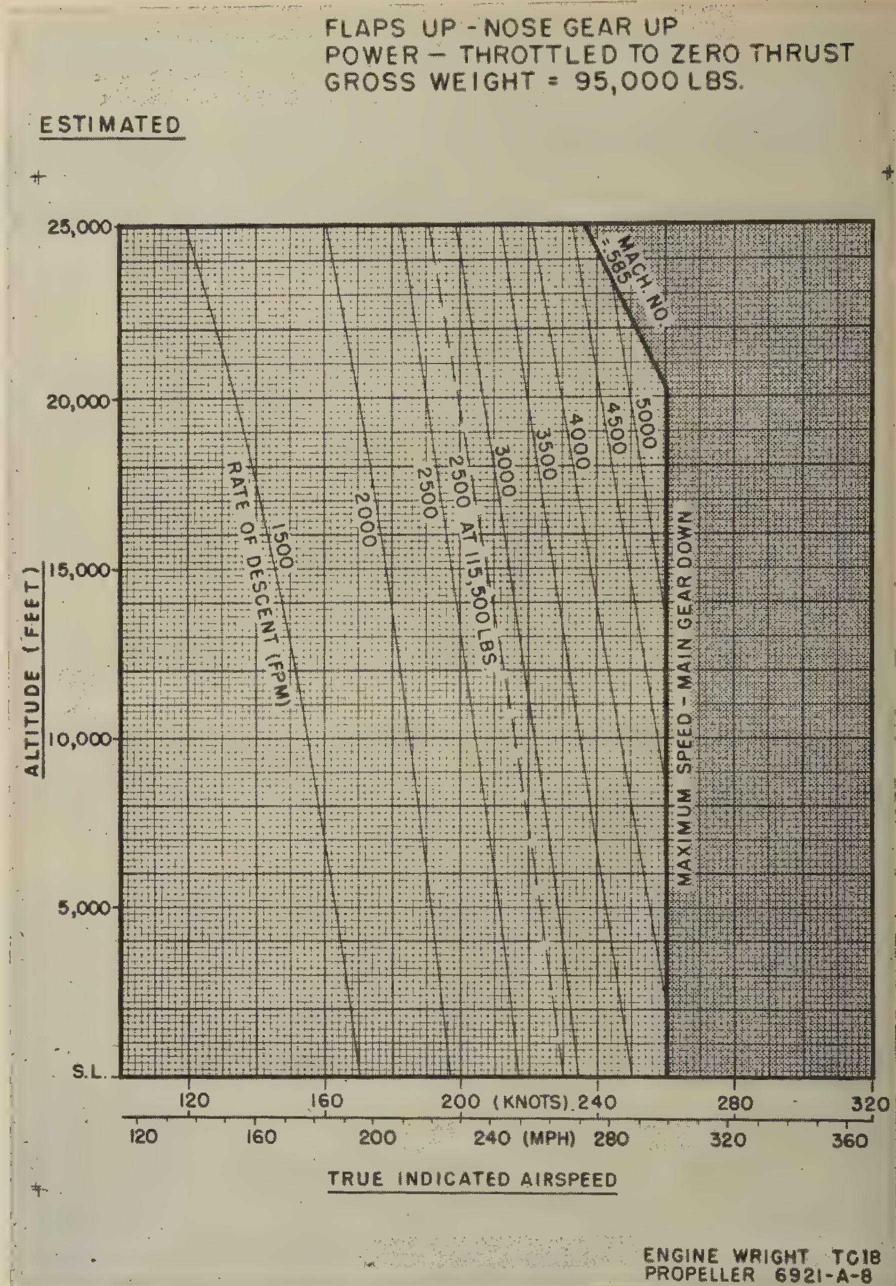

CHART 4

Suppliers to DC-7

U. S. Steel	Steel stocks
Alcoa	Structural alloys-tubing
Hamilton Standard	Props
General Electric	Generators and related equipment
Cannon Electric	Electrical connectors and related equipment
AiResearch	Cooling turbine; oil radiator and controls
Wright A. C.	Engines
Minneapolis-Honeywell	Fuel gauges
Bendix	Radio
Sperry	Automatic pilot
Pioneer	Instruments
Kollsman	Instruments
Collins & Aikman	Rugs, fabrics
Blanchard Bros.	Leather
Airtherm	Crew seats
Dupont	Paints
Vickers Inc.	Hydraulic pumps and related equip.
B. G. Corp	Spark plugs
Pesco Products	Pumps
W. Whiteaker	Valves
Thompson Products	Fuel pumps
U. S. Rubber	Fuel cells
Skinner	Filters
Church Co.	Toilet Seats
Webber Showcase	Wash Basins
Elgin	Clocks
Lewis	Instruments
Liquidometer	Instruments
Barber-Coleman	Temperature Controls
U. S. Gauge	Instruments
Weston	Instruments
Exide	Batteries
Jack & Heintz	Electrical equipment
Carrier Corp.	Refrigeration equip.
Rohm & Haas Co.	Windows
Burndy Electric	Electrical equip.
Collins	Radio
Telephonics	P.A. speakers
Alco	Windshield wipers
REF Manufacture	Buffet
Surface Combus.	Heaters
Remington Crucible	Titanium
W. Kiddie	Oxygen, Fire fighting equipment
Cleveland Pneumatic	Landing gear
Aeroquip Corp.	Hose
Luminator Inc.	Cabin lights
Durug	Floor Covering
Monsanto Chemical Co.	Hydraulic fluid
Minnesota Mining & Manuf. Co.	Sealant-cements
Roebling	Cable
Leach Relay	Electrical equip.
U. S. Plywood Corp.	Flexwood
Roylyn Inc.	Tank filler neck caps
Sierracin	Transparent partitions
Goodrich Co.	Vinyal fabrics
Dow Chemical	Magnesium
Foam Rubber Prod.	Cushions
Owens-Corning Fiberglas Corp.	Insulation

FIG. 3 **CAA RUNWAY LENGTH REQUIREMENTS**
Sea Level—Standard Atmospheric Conditions

Weight (lbs)	Take-Off		Landing
	With Auto Feathering	Without Auto Feathering	
122,200	6,050 ft	......	......
114,600	5,150 ft	5,550 ft	......
97,000	......	......	5,600 ft

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GULF
AVIATION PRODUCTS

Stop-Distance . . .

(Continued from page 19)

ways to alter the decelerating force: 1) Increase the coefficient of friction—which is ruled out since it is largely determined by runway surface, or 2) increase the proportion of weight on the wheels. The latter is under pilot control and is the method that assures the greatest reduction in stopping distance.

Figure 4 *(right)* lists the coefficient of friction of several typical runway surfaces. The chart is not complete, but offers a clear indication of the braking to be expected.

Relatively high landing speeds do not punish the pilot as much as might be expected provided he uses the optimum landing technique represented, for example, by the dashed lines in Figure 2. Of course, the slowest touch-on speed possible is always the best procedure, but the faster touch-down speeds are frequently forced on the pilot under low-approach conditions. The graph does indicate, with the low-friction dashed line, that the lower the coefficient the more severe the penalty of an increase in touch-on speed, even though optimum landing technique is followed. Unfortunately, the higher landing speeds are associated with the kind of weather that usually messes up the runways and cuts the coefficient of friction.

Figure 3 *(page 19)* takes a DC-3 and illustrates the effect of different pilot techniques on the same runway surface. Note the difference between lifting the tail to level flight and just leaving it two feet off the ground.

A DC-3 can be landed shorter more often by the average pilot with a main-wheels landing instead of a three-point for the simple reason that it is easier to spot the plane on the near-end of the runway. Of course, as the chart proves, the three-pointer is mathematically preferred because it is the slowest. But it requires a fine hand at the controls to prevent floating past valuable runway distance as you feel for the ground.

The table (Fig. 5), computed by Capt. Feazel, shows the weight increase on the wheels by changing the angle of attack and retracting the flaps.

Such factors as runway down-slope and tail wind are not as critical as might be surmised. In both cases the main difficulty lies in the length of runway that may be flown over before wheel contact is established. As to air density, the net effect of a reduction in this variable is a slight increase in landing roll. Center of gravity has little effect if the *cg* is within authorized limits.

In closing, it should be mentioned that all of the preceding holds true even when an aircraft is equipped with reversible propellers. Reversible props are merely an auxiliary stopping force.

COEFFICIENT OF FRICTION

	FREE ROLLING	INCIPIENT SKID		SKIDDING	
		Dry	Wet	Dry	Wet
Rough Concrete	0.05	0.8	0.7	0.6	0.35
Turf		0.5			
Macadam				0.3	0.15
Ice					0.1

FIGURE 4

DC-3 AT 24,400 POUNDS			
MPH	Weight on Gear, Pounds: 3-Point Attitude Flaps Down	Weight on Gear, Pounds: Level Attitude Flaps Up	Gain
70	0	18,490	18,490
60	0	20,070	13,870
50	7,300	21,380	9,670
40	13,450	22,468	6,188

CONNIE AT 85,000 POUNDS			
MPH	Weight on Gear, Pounds: Nose Wheel Off 100% Flaps	Weight on Gear, Pounds: Nose Wheel on T.O. Flaps	Gain
100	0	32,300	54,500
90	0	42,300	44,100
80	16,300	51,300	35,000
70	32,500	63,200	30,700

FIGURE 5

Electronics

(Continued from page 23)

and hence complexity, will *have* to increase in proportion to the rate of increase of speed and altitude.

World War II saw the first application of complex electronic gear to the air battle (as well as to sea and land warfare). The introduction of radar to extend human capabilities in detection and ranging for fire control and bombing was certainly a milestone both in the military and in the electronic industry. While it is undoubtedly true that this development contributed greatly to the achievement of mastery over the enemy, it is also true that specific results fell far short of the goals envisaged by the designer and manufacturer of this equipment. There are two basic reasons for this lack of effectiveness—unreliability and complexity of operation.

In retrospect, it is apparent that this unreliability was inevitable considering the astonishingly short period given to development and design. But the greatest reason for its unreliability was the revolutionary nature of the impact of such complex gear, introduced in such a short time, upon the maintenance organizations of the services. This was like asking a building construction electrician to repair a television set and withholding the circuit diagram. Looking back, it seems a wonder that any effectiveness was achieved at all, and much credit must be given to the electronics industry and to the spirit of cooperation and the understanding of its technical representatives in the field.

The other reason was termed "complexity of operation". It will be shown that this is an entirely different thing than circuit complexity and this is very important. Complexity of operation brings in the human who uses the equipment. The electronic equipment used in the Air Force in World War II simply required of the user so many parallel actions and this at a time of great emotional strain, being under attack, that his ability to reason and rationalize was destroyed. The result was a great plague of gross errors in the case of bombing which was difficult for the designer of the equipment to understand or explain. These gross errors were the result of the operator actually forgetting to perform some important calculation, or actually making an erroneous calculation, or failing to apply reason to a sudden turn of events.

In the developmental evolution of Air Force electronic equipment during and immediately following World War II, analysis clearly showed what the limitations of the user were. An important decision had to be made. This decision was to accept the limitation of the human and to stay within these limitations by complex instrumentation which accomplished many of the tasks and computations automatically. The aim was to achieve maximum utilization of the reasoning capability of the human, which cannot be instrumented, by removing the confusion factor caused by overloading him. The penalties to be incurred by circuit complexity in the form of unreliability and difficult maintenance were clearly understood and considered in the decision.

There seems to exist a certain amount

(Continued on page 44)

Electronics

(Continued from page 42)

of confusion between the terms circuit complexity, operating complexity and reliability. It is obvious that circuit complexity and reliability are basic problems facing the equipment designer. The problem is to accept the fact that circuit complexity is necessary and to go about the business of achieving reliability in spite of complexity. A certain amount of introspection can convince one that in the eyes of the user circuit complexity and unreliability are synonymous. If a black box performs its function day after day, never requiring disassembly or attention, to the user it is a simple gadget regardless of the wondrous jumble of tubes, capacitors, resistors and whatnot which may be hidden inside. The goal of the designer, then, is to make the user believe that a complex equipment is really simple. We have examples of this in our homes. Almost every home in the country has a telephone. To millions of persons this is assuredly a simple device, since it seldom if ever fails and is easy to operate. To those who spent thousands of hours designing, testing, redesigning and retesting to achieve this almost perfect reliability, it was hardly a simple task, nor is the welter of electronic instruments in the modern automatic exchange to be considered simple. The telephone system, incidentally, also illustrates to some extent the earlier contention that *from the system standpoint,* in both the economical and accuracy aspects, optimum utilization should be made of the human being *and* electronic instrumentation. The telephone system still utilizes people to apply reasoning power to sort out the weird questions which we can pose from the other end of the line, but has removed from the human the mechancial tasks of making proper connections to connect us to the right party. There are many other examples in daily life which need not be mentioned here.

An attempt will now be made to demonstrate by means of some simple curves that the decision to try to achieve proper balance between human and instrumentation, at the cost of circuit complexity, was a most wise choice on the part of the Air Force.

Figure I contains five curves based on factual data concerning one particular type of Air Force Weapon system. Because of this factual nature, the figure is lacking in a quantitative sense, since these data are classified information. Nevertheless, much can be learned from a study of these curves. The curve entitled "Instrument Accuracy" is included because precision of computational accuracy does have a bearing on complexity and reliability, and the disparity between instrumental and operational accuracy is explained by the other three curves. It should be noted that a high order of instrumental accuracy was available even at the beginning of World War II. However, the disparity between this and actual operational accuracy was enormous because of the large demands upon the human at the wrong time.

Introduction of radar increased the operator's capability but complicated his task to a great degree so we have the "operator's task" curve rising to a broad peak around 1944, with a corresponding degradation in the "operational reliability" curve. "Instrument Accuracy" was also degraded because of the coarser nature of the radar data inputs and of the lesser accuracy of the electronic solution vs. the previous mechanical computation. These curves improved slightly between 1944 and 1946 which reflects an increasing capability in maintenance and adjustment and an admirable support of the Air Force by the electronics industry.

The first radical change in these curves coincides with the introduction of the new equipment designed to best use the human operator. The "operator's task" curve goes rapidly from complex to relatively easy, and at the same time the "operational reliability" curve rapidly falls into a dangerously low level. The double low spot in the "operational reliability" curve resulted from the introduction, about a year apart, of two different configurations of this new concept, the second more elaborate in capability and complexity than the first. The climb back to respectibility of the "reliability" curve was achieved by an agonizing and very expensive "bootstrap" operation in which basic mistakes of installation which adversely affected the equipment environment were corrected, the usual two-year gap between engineering knowledge of deficiency and actual production line quality was overcome, and the capability of the using organization made a surprising improvement. This was a period during which the Air Force was learning to live with circuit complexity. That this was possible is demonstrated by the rapid rise of the "reliability" curve during the period 1949-1953.

The "complexity" curve is a rather arbitrary one, since this is hard to measure in chart numbers. It does illustrate the revolutionary nature of what took place between 1942 and 1948.

The significant thing about this figure is, of course, the "operational accuracy" curve. The fact that it shows a steady rise during all the gyrations of the other curves is a thing of tremendous importance to the nation and, it is believed, proves that the decision in favor of circuit complexity was a sound one.

The fact remains, unfortunately, that reliability is at present far from acceptable, and while learning to live with electronic equipment complexity we have continuously had present that ugly unwanted bed-fellow "unreliability". We know, now, that we have capability, but for it we are paying far too high a price in maintenance, attrition and mission failures. The challenge obviously is to learn how to build reliability into complex electronic equipment. The Air Force has not the slightest doubt that the electronics industry will be able to achieve this. We are, of course, interested in how soon, not only because of cost considerations, but also because the quality of the nation's security is inextricably involved.

The Air Force technical personnel have recently come to recognize that the only way to achieve a position where our customers, the operating Air Forces, can be led to believe that complex electronic equipment is in fact simple and reliable is by approaching the problem from the complete "systems" viewpoint. This is how a "simple" black rubber telephone instrument was achieved. A modern weapon system is an extremely complicated thing and the problems of inadequate technical administration of such a project are enough to stagger the imagination. The galaxy of specialized talent which must work together on such a project includes representation from all fields of the aerodynamic, mechanical, optical, geodetic and electronic arts, as well as human resources research, basic materials research, aeromedical research, not to mention the basic military sciences. The Air Forces technical administration is keenly and humbly aware of the enormity of the task and looks to the industry for a large measure of the necessary aid.

The author believes that it is in systems engineering in complex electronics systems work that the real challenge to the present day young engineer lies. It is work that does not appeal to the type of person who desires to specialize and acquire a great store of knowledge about some distinct and unique portion of the field. Nor does it continue for long to appeal to the type of individual who likes his days to be serene and his nights untroubled. It is difficult work, but unbelievably rewarding in the sense of real accomplishment and service. The young man who is fortunate enough to get in on the conception of a systems project, and can stay with it through the many years required for development of such a project, emerges with a mature sense of his own capabilities and is usually then equipped to engage in technical administration work. Systems engineering work is the most broadening of any phase of the profession and is a liberal education in itself.

In general, the Air Force has enjoyed the best of relations with the electronics industry, and is deeply appreciative of the spirit of understanding and cooperation that has existed. Air warfare is young and dynamic, and consequently subject to continuing change based on experience and technological advancement. Its technical programs are full of unique problems—unique because the environment in which airborne electronic equipment "lives" is certainly unique, and this is one of the most difficult problems to overcome in the struggle to achieve reliability in spite of complexity. These special problems are of the type which require the most thorough cooperation between the industry and the military departments.

In summary:

1. Modern military equipment, to achieve the most precise solution to dynamic problems, must rely on complex instrumentation to permit optimum use of the human being.
2. To the user, complexity of itself is of no real significance except as it affects reliability.
3. The "systems" concept in engineering administration and technical control is essential to insure success in achieving reliability.
4. Systems engineering is the new frontier in the engineering profession.
5. Our goal must be to achieve reliability in spite of complexity.

This article is an adaptation of a paper presented by Mr. Nordlund to American Institute of Electrical Engineers.—Ed.

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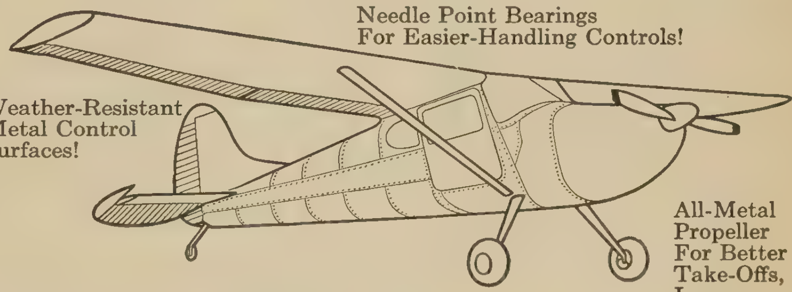

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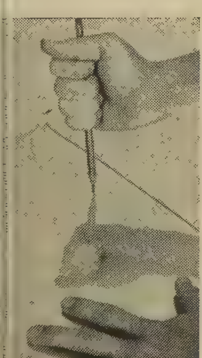

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Service and Sales

(Continued from page 17)

American's parts needs. They had selected only those items (primarily Bendix Scintilla magneto parts and units) which they felt could be handled with real benefit to American. As a result, all the promises made by Jalonick came true. Southwest Airmotive's sale of parts to airlines was launched.

Today, Southwest stocks nearly half a million dollars in parts. They regularly supply certain parts to 11 airlines: Braniff, American, Delta-Chicago and Southern, Continental, Pan American, Slick, TACA, Trans-Texas, Frontier, Pioneer and Central. Quite frankly, the market is still subject to a lot more selling. There is still a feeling among some airlines that a distributor merely gets in the way, that he is a parasitic middleman whom everybody could do without. But this feeling is gradually growing weaker. As one airline executive put it: "Southwest Airmotive is a valuable *second source*. In this business, a second source that we can depend on is worth its weight in gold."

War-surplus parts are gradually disappearing from the market and as this happens the position of a new-parts distributor like Southwest naturally grows stronger. Southwest realizes its responsibility for maintaining a sharp liaison between the airlines and the manufacturers of the parts they use. Southwest makes it a point to stay up-to-the-minute on all bulletins, proposed design changes and other matters affecting the maintenance situation. They pass this information along immediately, either by telephone or by direct contact. And, as Jalonick predicted, the airlines have not lost their personal touch with manufacturers.

Jalonick's efforts in organizing parts sales to airlines created national attention and won him the 1953 presidency of the Aviation Distributors and Manufacturer's Association. He feels that other distributors beside Southwest can and should take part in this worthwhile operation. However, he cautions them to approach the matter in a businesslike manner, making the same sort of basic investigation which he carried out with American, before diving off the deep end. A few irresponsible distributors who make promises they cannot back up will ruin the chances of good operators who are willing and able to do a good job.

Actually, the first realistic move which cleared the decks for progress in the Southwest organization was the dropping of new-plane sales in the late 1930's. Company officials studied the books and discovered that demonstrations, inventory, bookkeeping and the other fixed charges were not being taken care of out of sales. So, with characteristic ability to accept facts, no matter how unpleasant, Southwest reluctantly advised the plane makers that they were dropping the franchise.

The real chance for profit, Southwest believed, lay in *maintenance*. Dallas was, and is, the heart of one of the greatest company-aviation territories in the world. Distances are great. Oil, cattle and industrial men in Texas have the kind of money it takes to buy and fly executive aircraft. People in the Southwest are air-minded. Dallas is an aviation cross-road between New York and the West coast, between Canada and Mexico. Love Field has a NW-SE 6200-foot instrument runway with a 1,000-foot overrun; a 5200-foot NS runway; and a 4300-foot EW runway. The instrument runway is equipped with a 2800-foot lane of high-intensity approach lights and a CAA-approved ILS. There is a 50 to 1 approach ratio on the instrument runway. And last, and best, the city has a master plan calling for the expenditure of some $17,500,000 for airport improvement at Love Field in the near future. There will be a new $5,000,000 terminal building, dual 8500-foot NW-SE runways, a complete relocation of most buildings, and a general streamlining of the entire field for more efficient operation.

What, Southwest asked itself, could be better for a company looking toward extensive maintenance of executive airplanes? They realized, of course, that their maintenance would have to be of the gilt-edged, blue-ribbon variety. "This could not be a shade-tree operation," says Winston Castleberry, Vice President in Charge of Service. "Our customers are the carriage trade. They are the most successful and most exacting folks in the business world. With people like that, one mistake and

ou're through." Castleberry added, "We ee to it that every possible effort is made o do a reliable, quality job."

This year, Southwest Airmotive is 22 ears old—and that's *old* in this business. They have hired good men, paid them well, ffered advancement, security, pleasant vorking conditions, and the various benets of insurance and vacations found in he more enlightened big business outfits nywhere. Not the least of Southwest's opularity has stemmed from their intelliient advertising, publicity and public-reations program. Everybody who lands and arks on their 30-acre concrete Welcome Mat is greeted with efficient, courteous ervice. Southwest is known as private viation's largest filling station. They umped three and a half million gallons in 952, to both civil and military ships. They ffer five grades of aviation gasoline, four ifferent weights of oil, and JP-4 jet fuel o wandering jets of the Air Force, who ave officially retained Southwest as their efueling home-away from-home. Customer eeds range all the way from 12 gallons of as and four quarts of oil for a Mooney o 11,000 gallons of gas and 100 to 120 uarts of oil per engine for a bulbous *lobemaster.*

Refueling standards are strict. All reiprocating engine fuel is passed through screen of 100 mesh or finer. No service an is permitted to carry pencils or other bjects in his shirt which might fall into gas tank and cause trouble. Trucks roll p in front of the plane the minute the rops stop rotating and the craft is fueled ght then unless the pilot requests otherise. To prevent the collection of moisture a company trucks and tanks, a qualified mployee uses litmus daily in checking for ater. The trucks are regularly sumped.

At the moment, Southwest is proud and xcited over the big addition to its enine overhaul shop, one of four P & W uthorized engine overhaul shops in the J. S. and one of three representing the Vright Aeronautical Corp. The operation as been on an assembly-line basis for a ong time and continues to be a mainstay f private-plane owners throughout the Vetsern Hemisphere. Past rate of comlete overhaul, putting an engine in a ood-as-new condition, was 200 engines month. The new addition permits a traight-through flow of engines and has tepped up output to more than 300 enines a month. Four soundproof test cells re joined directly to the end of the new ssembly bay, and each reconditioned enine goes right from its assembly stand to st, without leaving the building.

Southwest Airmotive is divided into two ain departments which work, in many ays, completely independent of each ther: Service . . . and Sales. The Service epartment must take its place at the nd of the line when it requires parts, oving up in priority just as an outside ustomer would. This eliminates bad feeling on the part of outside buyers who ight feel that the part they so badly eed is being turned over to Southwest's wn service group.

Southwest is also in the conversion busiess. They are equipped with a radio hop, instrument shop, upholstery, fabrication, hydraulic, electrical, powerplant and propeller specialists, to install the finest, most-complicated type of equipment in fast time. Lockheed *Lodestars,* Twin Beeches, DC-3's, North American B-25's and others have been converted by Southwest and are giving excellent service in many parts of the world. One little-known conversion operation which has proved profitable is the plushing up of new Aero *Commanders* which are flown to Southwest in a stripped condition and built to luxurious specifications before delivery to the buyer.

As recently as 1946, Southwest Airmotive occupied but one building at Love Field. Today, the pilot landing at Love Field is literally surrounded by Southwest, which now utilizes five hangers and a sales warehouse located on both sides of the airport. Southwest's biggest news in 1953 was the new engine overhaul addition to "Hangar 4", which doubled the shop's working area.

Southwest has had numerous offers to establish branch operations in various parts of the nation. The management has considered these carefully, and politely declined. "Quality," Jalonick says, "is what we sell. We can keep it that way if we stay in Dallas and stay in one piece. And that is a lot more satisfactory than knocking ourselves out doing a job we might not always be proud of."

Paratroops—Helitroops

(Continued from page 14)

training at Gary Air Force Base near San Marcos, Texas, and are qualified at Fort Sill in five weeks.

The Marine Corps has trained 550 whirlybird flyers during the past three years and this year 144 more Leathernecks will earn their wings.

The tactical value of helicopters was immediately apparent to combat commanders in Korea, and the Army already has adopted the infant of aviation as the fourth member of its tank-artillery-infantry team. Each infantry and airborne division now is equipped with 10 light helicopters, and armored divisions have seven of the versatile little hoverbugs. The Army already has in operation five transport companies of 21 cargo 'copters and two reconnaissance 'copters each, two in the Far East and three in this country.

Col. W. B. Bunker, chief of the Army Air Transportation Services Division, has disclosed that the Army now is working toward a goal of 36 transport helicopter companies.

Combat unit commanders in Korea found the light utility 'copters indispensable as reconnaissance, observation and artillery fire-direction planes. Time and again they were called upon to lay communications wire for fighting troops, and they performed in minutes this job which once required hours of hard, dangerous work by Signal Corps soldiers. The mere presence of one of the Army's "eggbeaters" over a battlefront often was enough to silence enemy artillery batteries which dared not fire lest they give away their positions. Fighter planes frequently were directed to ground targets by Army and Marine Corps helicopter pilots and staff officers were flown to critical combat areas in record time. Traffic snarls on Korean mountain roads were unravelled quickly by Military Police officers hovering overhead. Army Engineers, highly enthusiastic about their newly found mobility, flew bridges into position piece by piece to save hours of back-breaking labor as well as time.

When a flood washed out the roads behind a large American unit heavily engaged with the Communists, the Army's Sixth Transportation Helicopter Company was called upon to re-supply the isolated troops. Ten H-19 Sikorsky helicopters went into action, and in one hour and 20 minutes each of the unarmed whirlybirds had made three round trips. In that short period they carried 34,000 pounds of food and ammunition to infantrymen whose supplies fast were running out. At times the 'copters were within 300 yards of enemy positions and were under fire from enemy small arms and mortars. One 'copter suffered slight damage from mortar fragments, but none of the crew was injured.

This re-supply mission was an unusual case, but even under normal conditions transport helicopters offer a tremendous advantage over road-bound vehicles. One hundred and five of the H-19's now in use can move five days' supplies for an Army division 60 miles in a single day. In the same 24-hour period, 105 two-and-one-half ton trucks can move two days' supplies the same distance.

The three rifle regiments of the 25th Infantry Division—on the front lines in Korea—were supplied entirely by 14 whirlybirds for three days in May, 1953. Flying through rain squalls more than half the time, the H-19's of the Sixth Transportation Helicopter Company delivered 622,000 pounds of ammunition, food and fuel to the infantrymen in this operation.

As bigger, better helicopters are delivered to the Army, the transport capabilities of the whirlybirds in combat will be increased greatly. Present capacity of the Army's flying truck, the H-19, is approximately one ton or 10 armed soldiers. But scheduled for delivery in the future are Sikorsky's H-34 which carries one and one-half tons or 14 men, and S-56 which carries 30 men or three tons, and Piasecki's YH-16 which carries five tons or 40 men.

In Korea, the actions of the helicopters were limited by the small number of aircraft available and relatively small cargo capacities. But in any future conflict, chopper pilots feel they will play a much greater, and perhaps decisive, role.

Tough, cocky paratroopers and their shiny jump boots and the familiar Army two-and-one-half ton truck are not going to disappear from battlefields overnight, but Army and Marine Corps hoverbugs are convinced that sooner or later the helicopter will do to them what tanks did to the leather-pounding cavalryman.

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

Skyways Round Table

(Continued from page 22)

as much as two or three hours, that we will cancel a trip, even though it could be operated according to good practice. Under such conditions, equipment and crew limitations must be fully recognized by both management and those responsible for flight operations, if safety is to be achieved."

Ed W. Hudlow: *"Do you have any suggestions that would be of value to companies that are just beginning their flight operations? Round Tables such as this are an important sounding board to assist newcomers in the business."*

Curtis G. Talbot: "In the early days of business flying when the operation of an airplane was just the hobby of the company president, there undoubtedly were many practices that led to poor safety. However, as business fleets have grown and the operations have been set up under qualified management experience in aviation, the possibility of either executive pressure or other adverse influences is minimized. I would strongly urge the newcomer to survey the operations of companies that have established outstanding records—General Motors, for example."

R. W. Lane *(Chief Pilot, Food Machinery & Chemical Corp.)*: "We are faced with the problem of proficiency in handling New York procedures, for example, because we are based on the West Coast and don't have occasion to go into New York, Washington or Chicago as frequently as many pilots representing corporations in that section of the country. For that reason, we stress proficiency in training. We make it a point to attend flight refresher courses periodically and we especially dwell on approach and air traffic procedures for the New York and other busy terminal areas. The main answer to the problem in our case is vigilance and training, remaining proficient and following a prescribed course of training to make certain we maintain that proficiency.

"I'm sure we all agree that a pilot who lands at LaGuardia two or three times a week is better qualified to land there under minimum conditions than a pilot doing so only once a month. Therefore, in addition to training, I feel that some consideration should be given to the so-called minimums. Because there is a minimum, it doesn't necessarily have to be followed down to the lowest minimum. There are times when conditions are safe at even lower minimums than the prescribed ones, but in our business we have to determine the situation as it is at the time we want to land rather than adhering to the actual published minimum."

Ed W. Hudlow: *"In other words, you give your pilots the authority to change their minimums up or down as their proficiency permits?"*

R. W. Lane: "No sir, not *below* the minimum conditions. We stress the fact that the pilot must decide whether a take-off or landing should be made. They are not

(Continued on page 52)

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- ☐ U. S. Air Carrier
- ☐ Business Aircraft Operator
- ☐ Fixed Base Operator
- ☐ Terminal Airport
- ☐ Non-Terminal Airport
- ☐ Foreign Government
- ☐ Military
- ☐ Consulting Organization
- ☐ Foreign Air Carrier
- ☐ Repair, Modification Facility
- ☐ Special Flight Service
- ☐ Federal Government (Civil)
- ☐ State or Municipal Government
- ☐ Research Organization
- ☐ Educational

MANUFACTURING

- ☐ Aircraft
- ☐ Engine
- ☐ Other

If not listed above, state branch of industry

2. Which heading best describes your occupation (your job) in the above organization? *(check only one)*

- ☐ Corporate Official
- ☐ Director
- ☐ Owner
- ☐ General Manager
- ☐ Engineering Dept. Head
- ☐ Supervisor
- ☐ Engineer
- ☐ Designer
- ☐ Consultant
- ☐ Superintendent
- ☐ Department Head
- ☐ Foreman
- ☐ CAA Inpector
- ☐ Licensed Flight Personnel
- ☐ Purchasing
- ☐ Commissioned Officer
- ☐ Enlisted Personnel
- ☐ Plane Owner
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2/54

Skyways Round Table

(Continued from page 50)

necessarily forced to comply with any minimum set of weather conditions."

Herbert O. Fisher: "In connection with Mr. Lane's statement, I would like to ask a question regarding the variation in take-off requirements. Is it a good idea to have procedures that permit one aircraft to take off under zero-zero conditions while another aircraft cannot, even though both may possess the same equipment and the pilots are equally proficient? I have seen many aircraft taking off from our airports under zero-zero conditions while airline aircraft of the same type were not flying. I am not questioning the pilot's proficiency, but I am wondering if it is a good practice for the industry to have one group of operators who can take off under those weather conditions and then have another group of operators who cannot."

George W. Vaughan: "There is a basic point in relation to that, and it should be discussed here. The CAA regulations today are so lax that there is no protection at all for the corporation that is going out to hire a pilot. That pilot may or may not be well qualified. I believe that any pilot flying for a corporation should hold an air transport rating. There is a definite need for a new type regulation that a corporation can read and understand without having to call in an attorney to interpret the regulations pertaining to his operation.

"Also, I don't think the company airplane should be allowed to exercise lower minimums than the established airlines. One reason is that, although the business pilot may be better qualified in technique, he is not as familiar with the route in every instance as the airline pilot is. Zero-zero take-offs are very common to business aircraft. But I do not think it is an inherently safe operation regardless of how good the pilot is.

"I don't want to harness companies with any more regulations than are necessary, but I think they should have some help from the CAA and not have to be dependent upon a pilot who may or may not be well qualified."

E. Tilson Peabody: "Before commenting on Mr. Vaughan's suggestions, I'd like to clear the record of one or two implications. Mr. Fisher has very ably pointed out the critical traffic situation in the New York area, and I'm sure we all agree with him. He also implied that there are pilots and equipment entering that area that are not fully qualified, and I believe that's true. However, I'd like to state that I believe in general the business aircraft is particularly well equipped and that their pilots generally are particularly well trained and skilled. Therefore, I feel we're talking about a relatively few companies and pilots, not the group as a whole.

"Regardless of the equipment on any aircraft in the business field, the pilot must know his aircraft's limitations. A Twin Beech, for example, can be especially well equipped, radio-wise, and can be an extremely useful aircraft in a business operation provided it is operated within its limitations. The same is true of the *Lodestar*, the DC-3, etc. We must consider the particular mission for the aircraft, the weather, the loading, the potential holding, and then operate it within its particular equipment limitations. If a pilot does that, I don't believe he'll get into difficulties in such critical areas as New York or Washington.

"We have one peculiarity in business-aircraft operation. We operate on a basis of anywhere and any time, and this spreads us out quite a bit . . . Canada, Mexico as well as throughout the United States. It is, therefore, quite possible that the first landing a pilot ever makes at a particular airport may be under minimum weather conditions. In other words, we lack frequency of operation except in particular cases. If we are to maintain a relatively high standard or margin of safety, we must back the pilot up with sufficient training facilities so that the first landing under minimum conditions will be, by all standards, a safe landing.

"One method of obtaining sufficient margin of safety for operations into infrequently used airports is to establish (within the company) higher weather minimums for such airports. Another thing that can be done is to provide a Link Trainer. A Link Trainer permits the pilot to work over his procedures prior to departure on his flight. The Link used as a training device for procedures and procedures only is very much worthwhile. The pilots of our company spend some two hours per month per pilot in the Link . . . and all on procedures. The New York area has a habit of making changes every little while, so even if a company has a great frequency of operations into the area, specific training is necessary in these procedure changes.

"Also in this matter of procedure changes, I'd like to recommend that the CAA take a long look at its method of mailing and the distribution of information on these procedure changes. Very often we don't get information about the changes quickly enough to do us any good."

Tom R. Neyland: "I'd like to comment on a different type of operation that is common in business flying. The pilot of a smaller airplane is still a business pilot, even though he isn't flying big equipment or all-weather equipment. Mr. Vaughan's suggestion that all business pilots have ATR's is a good one, but I don't think it is always required. Perhaps a company owns a *Bonanza* and they're not going to be operating under conditions of weather minimums. I don't think that a pilot should be required to have an ATR, although he's still a business-aircraft pilot. When you start setting up rules and regulations for business airplanes, we have to remember that they come under many different categories, from *Cub* to Convair, and it would be pretty hard to set up regulations covering all.

"Concerning this matter of zero-zero take-offs, the locality of the airport, the geography of the surrounding area might dictate whether or not a zero-zero take-off was reasonable and safe. Lake Michigan frequently blows in a fog that covers an airport, but just five miles away it's as clear as a bell. In other localities, however, under zero-zero conditions, a possible alternate airport for use in case of emergency might be as many as 500 miles away. I think the decision regarding take-offs under those conditions is up to the pilot and comes under pilot training."

I. T. Holman: "The important thing is to have the pilot recognize his own limitations and the limitations of his equipment. As far as take-off minimums are concerned, the airlines operate with take-off minimums, and I think business aircraft should also operate with take-off minimums."

Ed W. Hudlow: *"You think the companies should set their own minimums, or do you think we should have regulations?"*

I. T. Holman: "I don't see why the CAA doesn't set them, especially in view of the fact that experienced men such as Mr. Fisher are questioning the judgment of pilots who are taking off under zero-zero conditions in New York area."

R. W. Lane: "I take strong exception to that. Like Mr. Neyland and Mr. Peabody, I feel that you can't legislate this type of flying, at least not to the extent that you have to legislate airline-type flying. We have too many different and unpredictable sets of circumstances to be able to evolve any sort of regulations that would cover all of them. For example, while I agree with Herb Fisher that something like 300 and a mile is a sensible take-off minimum at LaGuardia, at my own airport at San Jose, California, where we have the broad San Francisco Bay to take off over and where we have excellent fields with excellent radio facilities within 10 miles, a take-off with 100-foot ceiling and a quarter-mile visibility is safer than take-off at LaGuardia over residential areas, industrial areas, etc., at 500 and a mile. This same thing is true at various other airports we travel to. You can't legislate a pilot's thinking in this type of business. He has too many different sets of circumstances to cope with. The best you can do is educate him to realize that he must have the background for doing the right thing under the right circumstances."

Ed W. Hudlow: *"We seem to have a difference of opinion here, Mr. Talbot, let's have your comments."*

Curtis G. Talbot: "I can't settle it, but I do have some thoughts. We have been up against this zero-zero take-off problem for some time, and I believe, with one or two exceptions, we have followed airline practice. It's difficult to explain to your executive passengers why you are operating to lower minimums than the airlines, but no questions are asked if you follow airline minimums. That may be taking the easy way out, but it does result in conservative operations."

Ed W. Hudlow: *"If I may, I'd like to give the CAA's general philosophy on this problem. We have seen the executive or business-aircraft operation expand, and we have felt that our established minimum standards provided in the regulations are so far exceeded by almost all business operations that we haven't felt the necessity to regulate safety into it. We have felt that the business flyers are a group that has its own procedures of self-regulation, that the group has set its own limitations for operations. Increasing the minimum*

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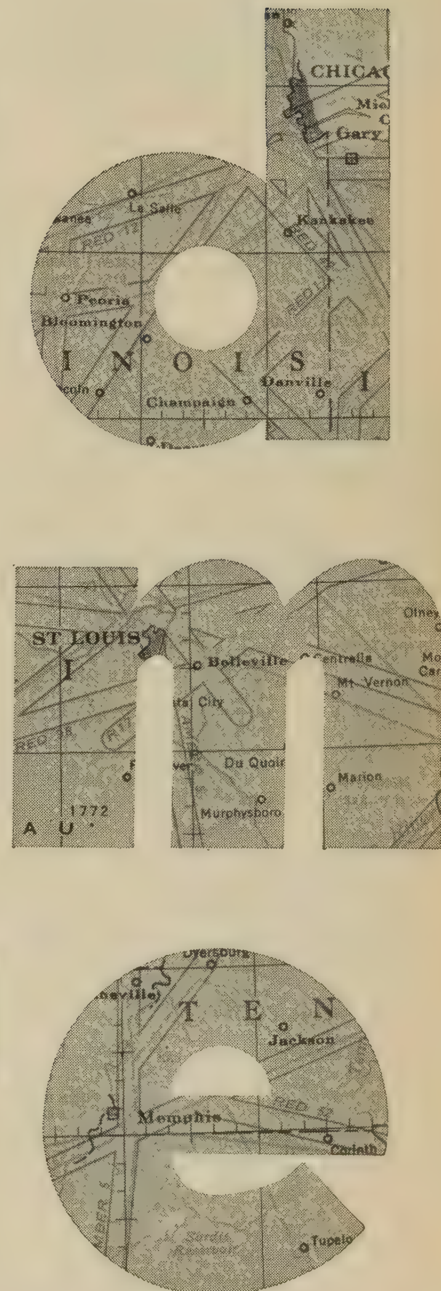

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Skyways Round Table

(Continued from page 52)

standard would not improve the situation."

Tom R. Neyland: "While I think it is good practice to follow the airline standards, I don't think it should be a rule and regulation. It should be a company policy or pilot policy. And I still think geography has a great deal to do with it.

"When it gets down to minimum operations, I don't think the reports are as accurate as they are said to be. Until newer or better ways to measure ceiling and visibility are found, I don't think we should have a minimum for take-off."

C. F. Zimmerman: "Most corporate pilots know which airports are all right for below-minimum take-offs, and they govern their decisions by that knowledge and experience. As far as failures are concerned, I don't think business aircraft are subject to as many failures as airline aircraft, because most business aircraft have dual VOR, the best and latest in radio, and most of them go through an engine change every 500 or 800 hours. The airlines try to run engines 1200 to 1400 hours."

Ed W. Hudlow: *"Does anyone else have comments to make on this subject of management, safety training and pilot relations? This is an important point to clarify in order to help people coming into the business-aircraft operational field and to support others who may be experiencing difficulties."*

R. W. Lane: "The extent to which there should be direct management supervision depends upon the size of the operation. Generally speaking, it's better to have a pilot in charge of flight operations. A little knowledge sometimes is a dangerous thing, and if the operation has to be responsible to a person who commands the operation just because he is an executive but who is not familiar with all the problems, he could conceivably influence the pilots to do things contrary to safety."

Herbert O. Fisher: "For the record here, I'd like to make it clear that when I brought up the subject of zero-zero take-offs, I wanted opinions. I realize that there are hundreds of business aircraft pilots throughout the country that are extremely well qualified to operate into any area and that the vast majority of business-aircraft operations are perfectly safe, but the Port Authority records some 7,000 movements of corporate and 16,000 movements of private airplanes at our airports in a single month out of a total of 55,000 plane movements. Thus, even the small percentage of business and private flight operations which may fall into a fringe area of safety are a matter of great concern."

I. T. Holman: "If business aircraft can take off when the minimums are below the airlines minimums, and private pilots can take off, why don't the airlines ask if they can do it?"

Tom R. Neyland: "As I understand it, that's a company policy governed by the individual airlines. They could go zero-zero if they wanted to. Am I wrong?"

Herbert O. Fisher: "The Civil Aeronautics Administration has established ¼ of a mile as the minimum take-off requirement for all air carriers at New York International Airport. However, individual companies can and do set higher minimums. Of course, they cannot set minimums lower than those established by the CAA."

R. W. Lane: "Doesn't the Port Authority have the authority to set up a minimum take-off condition regardless of whether it's an airline, a company or a private plane?"

Herbert O. Fisher: "No. We cannot close an airport or a runway because of weather. It is our responsibility to close a runway whenever a condition on the surface of the runway makes it unsafe to operate. Examples of such conditions would be pavement defects, deep snow, snow-removal operations, construction or repair operations in progress, a disabled plane or vehicle on the runway."

Ed W. Hudlow: *"Is it true that the airlines have a committee that decides when the airport should be closed to all, rather than one taking off and another one not, particularly during winter operations?"*

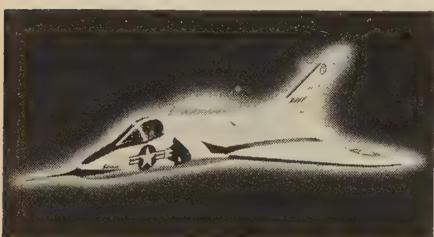
Herbert O. Fisher: "In a sense, you might call it that. Naturally, the station managers of the various airlines, the tower operators, and the airport's operations personnel many times confer and exchange information on prevailing conditions. But actually the final decision concerning whether a runway shall be closed is one for the airport manager. The CAA must decide on the basis of information it gets from the weather bureau if take-off or landing weather is good enough to allow air-carrier operations. The various airlines must decide, based on their own minimums, whether they wish to operate even if the CAA is quoting the lowest permissible operating minimums. In actual fact, there are many occasions when some airlines at an airport are operating and others are not. This is due to variations in operational minimums and procedures between air carriers."

Ed W. Hudlow: *"Mr. Zimmerman, when you were with an air carrier, wasn't it a joint agreement between the air carriers and the CAA that they set up the minimums? In other words, the company recommended minimums and then they were approved by the CAA?"*

C. F. Zimmerman: "No, I believe CAA really set the minimum, and then the inspectors would run a flight test to simulate approaches and would either raise the minimum or lower it. I don't know exactly how they do it now, but that's the way it was when I was with them."

Sidney F. McCullough *(Supervising Agent, St. Louis Aviation Safety District Office, CAA):* "The CAA does prescribe minimums for air carriers. However, it cannot prescribe take-off minimums for any other operators. This means that private flying, military flying, and business flying are not restricted insofar as take-offs are concerned, and take-offs are at the pilot's discretion in any kind of weather outside a control zone. If the take-off is in a control zone and the minimums are below 1,000 and 3, the pilot must get a traffic clearance from ATC.

"Perhaps we've touched on an added complication here. How does the fact that



n Doe, a private pilot flying a Cessna or a *Bonanza,* taking off in zero-zero ther affect your safety?"

W. Lane: "If he's on a clearance, he uldn't affect our safety one way or an- er."

orge W. Vaughan: "Let's face it, any ident in the aviation industry affects all us. When I spoke of regulations and t requirements from a CAA level a le ago, I was thinking of our protection n a below-standard pilot. Any opera- is set up based on the weakest link, on the average. Our regulations today based on the average pilot's efficiency, on the low boy. And we all know there business aircraft being flown today pilots who are on the ragged edge of ficiency. Those are the pilots who will k their necks out and over-extend them- es, whereas the average or above-aver- pilot in experience and ability uses er judgment."

n R. Neyland: "We've discussed air- and business-aircraft take-offs, but t about landing minimums? The airline t has his minimums, but I have yet know the airline pilot who has failed ake a shot at his minimum even though wasn't at that moment physically up to . Maybe he didn't sleep good the night ore, but he still takes a crack at his ding. The company pilot doesn't go in ss he wants to. Even if he has 1,000 3, if he's tired and doesn't feel right, won't and doesn't have to try the land- But the airlines have to. In that se, business flying is safer than airline ng."

W. Hudlow: *"Your over-all operation- record indicates a great deal of caution being exercised all along the line."*

Tilson Peabody: "It has been indi- ed that it is not illegal for a business craft to take off under zero-zero condi- s. It has not been indicated, according my understanding, that it is not illegal land at an airport when the reported ther is below the published instrument imums. I wonder if we should broaden viewpoint and see what affect this has the over-all safety of business aircraft. mentioned as one deterrent to safety possibility of executive pressure. There till another—pilot competition. It seems me that unless we are consistent in take-off minimum and in our landing imum in business-aircraft operation, re going to put pilots in a rather barrassing position at times, encourag- executive pressure when the pilot ides to stay on the ground while others e off, or when one aircraft is unable to d while others do land. That situation ourages pilot competition which tends cause the individual pilot to extend self beyond his known rational abili- . Looking at it from the over-all safety ndpoint, perhaps we should have some sistency in our take-off limits and land- limits."

W. Hudlow: *"Do you think that uld be by regulations or by mutual lerstanding among business operators?"*

Tilson Peabody: "I believe the re- nsibility is the CAA's. The CAA pub- es landing minimums but they're not uired to enforce them. They publish e-off minimums for air carriers, yet s not illegal for business aircraft to ignore them. I think that inconsistency should be cleared up by the CAA."

Sidney F. McCullough: "I'd like to make a correction or two. Take-off minimums are published, but they pertain only to air carriers. Lower take-off and landing minimums are frequently prescribed for air carriers, but they are not published. It is not illegal to ignore take-off minimums since they are not applicable to other than air carriers; however, landing minimums are applicable to all users and they are enforced."

George W. Vaughan: "In almost every case, the published landing minimums are higher than the scheduled airlines'. and business-aircraft operations are being crippled in some respects by that. We're given little consideration for an ILS approach, for example. Most of them are either 400 and ¾ or 300 and ¾, whereas the airlines in many cases get 200 and ½ on an ILS approach."

C. F. Zimmerman: "Personally, I'll stick to the 400. You have to be going in and out of an airport continually before you want lower minimums."

Tom R. Neyland: "Along that same line, I think the decision is still the pilot's. If one pilot can have 200 and ½ and feel perfectly safe in that operation and he has the equipment for it and the know-how, then every pilot should be allowed the opportunity. I don't see why one pilot with his equipment and knowledge is al-

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SKYWAYS FLIGHT OPERATIONS ROUND TABLE

Skyways Round Table

(Continued from page 55)

lowed a lower minimum than another pilot who has better equipment and very possibly greater knowledge and proficiency."

Sidney F. McCullough: "In this matter of equal landing minimums for all qualified pilots, perhaps I should point out here that the CAA has a policy for issuing waivers to specific pilots who have proved their ability to execute approaches at lower minimums than those published. Normally, this is for the home airport. However, it may be extended to any other airport. Minimums can be issued down to the lowest established for air carriers for the particular airport. A pilot who wants such a waiver should contact his local CAA Aviation Safety office and work out the details with an agent. This involves a pilot training program, a six-month instrument check and equipment checks when the aircraft involved are over 12,500 lbs gross weight, just as is required of air carriers."

Ed W. Hudlow: *"Is the six-month check mandatory?"*

Sidney F. McCullough: "If a waiver is issued for lower than published minimums, the six-month checks are required. It is a special provision of the waiver."

Tom R. Neyland: "It's my understanding that if a pilot has a waiver, the airplane as well as the pilot gets a six-month check. In other words, you might have a six-month check on a waiver to 200 and ½ on one airplane, but you have to take another check if you want to operate to those same minimums in another or different airplane. It that right?"

Sidney F. McCullough: "That is right."

Ed W. Hudlow: *"In summing up this whole discussion, I think it is important to have the final thinking of all of you. Mr. Peabody, would you comment on the over-all problem of regulations again?"*

E. Tilson Peabody: "Generally speaking, the history of business-aircraft operation has been such as to make doubtful the value of specific regulations at the present time. Considerably more work is necessary within the individual companies and in group discussion such as this for an exchange of ideas on how we can improve safety, but I don't see where we could profit at this time from more detail, regulation-wise, from CAA. However, from my own personal viewpoint, I would encourage an increased interest in the problem on the part of CAA. We have found in our own local area that cooperation from the CAA has been extremely helpful. They have seen our problems and they have assisted in the solution of them, and have come up with answers that have been extremely helpful.

"I have made a very specific recommendation relative to regulations concerning landing and take-off minimums for pilots of business aircraft, and I have not changed that. I believe appropriate weather minimums should be established, published, and enforced—and existing loop-holes closed. In the general field, I think the CAA attitude toward the problems of the business-aircraft operator is sound, helpful and good. I'd like to see that continue or possibly accelerate."

I. T. Holman: "Mr. McCullough, you reported the CAA does not have the right to set take-off minimums for business aircraft. Is that right?"

Sidney F. McCullough: "That is correct."

I. T. Holman: "But you do have the power to set landing minimums?"

Sidney F. McCullough: "That's right. It's a matter of Civil Air Regulations."

R. W. Lane: "I would like to inject a thought for the de-emphasis of regulations and minima. I'm not ready to say that we should do away with landing minimums and take-off minimums, but I feel the record of business-aircraft operations has shown that in operating in a free-lance manner, they can operate safely. Because there are so many geographical differences in fields and differences in equipment, it's entirely conceivable that a minimum, for example, of 200 and ½ at one field is very safe, while 700 and 5 at another is not. Therefore, I'd like to see no increase in regulations by CAA, but rather a stressing of the individual pilot's sense of responsibility."

C. F. Zimmerman: "There's a little mix-up here on the CAA. It's the CAB that makes the rules; the CAA primarily enforces them.

"As to whether or not we should have more regulations, for the time being I think we should continue as we have. We have a good record now. If it should deteriorate, then we can call for more regulations."

Curtis G. Talbot: "In view of all the variables in this business-aircraft operation, I think we've had a very excellent and helpful discussion here. It does seem to me that there is a need for business-plane operators to fully appreciate the limitations, both in crew and equipment, and use the best possible judgment so that the safety record can continue."

George W. Vaughan: "The safety record we are talking about is based on fatalities per passenger miles, which is good. But what I brought up earlier was with respect to the mishaps and accidents that do occur in various localities, the ones that we only hear about, second-hand. Many thousands of company dollars have been spent because of accidents that were caused by pilot inability. All of which goes back to the point I made of the companies new to aviation going out and hiring a pilot without knowing how to either measure a pilot's ability or judge exactly what kind of a pilot they need."

R. W. Lane: "This is slightly off the subject, but recently I ran into a device that has been patented but not publicized. It's a simple lightweight, inexpensive auto-feathering device, and I'm wondering how this representative group feels regarding the need for such a gadget on presently operated twin-engine aircraft."

C. F. Zimmerman: "I think it would be helpful. Let's say, for example, you take off some night and have a 500-foot ceiling. The cockpit's awfully dark, and suddenly you lose an engine. You take your time because you have to be sure you get the

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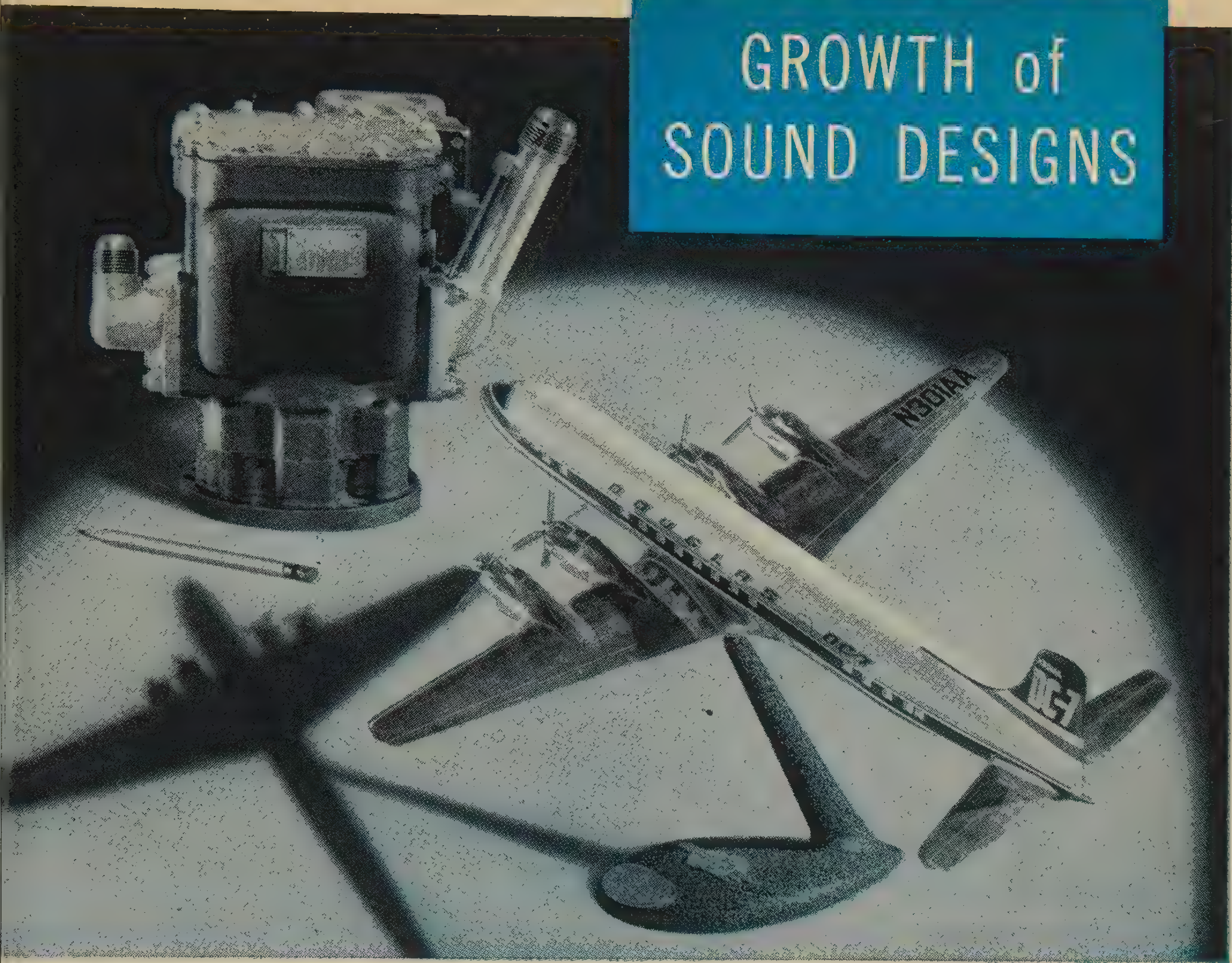
GROWTH of SOUND DESIGNS



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SKYWAYS FLIGHT OPERATIONS ROUND TABLE

Skyways Round Table

(Continued from page 56)

right feathering button, whereas an automatic device might do it for you in 3½ seconds. I'd say it would be helpful."

E. Tilson Peabody: "Any safety device merits consideration. However, that consideration should also take into account what other hazards might be introduced by use of the device. History has indicated that when you add a device to correct some difficulty and introduce the problem of lack of dependability upon the pilot, the net result has been a reduced safety margin rather than an improved one."

Tom R. Neyland: "Mr. Peabody is absolutely right—safety devices should be fully evaluated. Such a device might sometime give you an inopportune feathering when actually you want the engine for just a little power. You might be in a situation where you'd rather have five more horses to get over the fence than try to save the engine. Perhaps if this device could be set up to merely simplify the feathering operation, it would work out."

George W. Vaughan: "Automatic feathering was introduced primarily to get an immediate feathering of the new type prop because the inherent drag of the prop at no engine power or at very little engine power is so terrific that the airplane cannot be controlled and still comply with T-category regulation. As far as business aircraft are concerned, they do not have that type of prop and, consequently, the drag created by the loss of an engine is not as critical as it would be with the Convair or the DC-6."

Ed W. Hudlow: *"Mr. Langenfield, do you have any safety problems that you'd like to put before the group?"*

F. H. Langenfeld *(Sales Engineer, Monsanto Chemical):* "My main reason for being here was to answer any questions that came up on non-inflammable hydraulic fluids. The airlines and the military services have been very concerned with the flammability of the presently used types of mineral oil hydraulic fluid, and records indicate that many aircraft have been lost because of hydraulic fluid fires. According to news reports, the recent *Leyte* disaster in Boston was attributed directly to a burst hydraulic line; the fluid atomized and some unknown ignition source set off the explosion and fire.

"In aircraft, with 3,000-lb or even 1,000-lb hydraulic systems, you have even more of a hazard than you do on a stationary piece of equipment such as the catapult mechanism on an aircraft carrier. At the present time, our non-inflammable fluid, Skydrol, is being used in about 500 transport-type aircraft. These include the DC-3, Convair 340, DC-6, and DC-7.

"To date, we have had about 2½ million flight hours on our non-inflammable fluid in various aircraft, and thus far it has done a wonderful job. Since the installation of the non-inflammable fluid, we have had no complaints about brake fires either. I was in New York recently and talked with some of the Pan American personnel. On a training flight recently, they burst a brake hose and the fluid squirted all over the hot brake plate, but instead of a fire, they merely had a lot of smoke."

Ed W. Hudlow: *"Is a lot of modification involved in the switch to your fluid?"*

F. H. Langenfeld: "At the present time, there are 12 executive DC-3 type aircraft using it, in addition to those airline aircraft that I mentioned. If you want to insert this fluid in your aircraft, it means a complete seal change of the hydraulic system. It would, therefore, be to a plane owner's advantage to install it at a major overhaul period. It does require a different type seal, but these seals have exactly the same service life as the presently used AN type seal."

Ed W. Hudlow: *"Do any of you find it difficult to obtain good radio repair work around the country? We are working to improve the radio standards of repair stations throughout the country, and we have now approved about 36 radio repair stations under the new standards. The radio industry, the electronics industry and the CAA are working together on setting up a standard for radio repair, and I think this group would be a good sounding board for us as to the effect of it."*

C. F. Zimmerman: "It is very difficult to get good radio work done at a lot of airports, and I think there's a definite need for what you are doing. About the only place you can get radio work done is at major airports."

Curtis G. Talbot: "The equipment used during the war was simple compared to the equipment in use today, and men who were trained in electronics during the war haven't been able to keep pace with the developments. Many have turned to other fields to make their living, so there is a real shortage of qualified personnel. I think one of the big problems is the lack of training facilities; another is the lack of steady volume of work to assure a dependable income."

Ed W. Hudlow: *"Gentlemen, I certainly do appreciate your assistance here. You were frank and constructive in presenting ideas and thoughts, and I'm sure it will be particularly helpful to newcomers in the business-aircraft field.*

"In summary, we have found that the relationship between management and the pilot is very important to safety. It is encouraging to learn that through the efforts of pilots to educate management, and management's willingness to learn, mutual understanding is being achieved in areas affecting safety.

"We have learned that pilots are aware of the traffic problem in congested areas, and are doing something about it. The key to the solution seems to lie in good equipment and crew proficiency, plus pilot appreciation of the limitations of his aircraft and himself.

"I was pleased with the general agreement that no additional CAA regulations are needed to govern executive operations. That is a healthy sign that this part of the aviation industry is doing a self-educating and self-policing job in improving operational and pilot efficiency.

"It is clear that safety—constantly increasing—is the first thought of our executive pilots."

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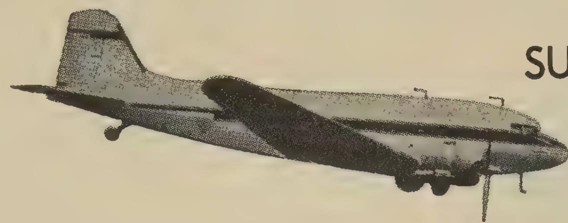

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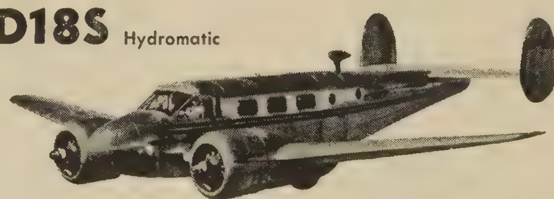

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Single Engine IFR

(Continued from page 15)

The Airplane

To even think of single-engine flight presumes knowledge of and confidence in first-class maintenance. If this is not assured, all bets are off. Granted this, however, it is interesting to note that engine failure as a cause of a single-engine airplane accident involving instrument conditions *on a bonafide IFR flight plan* is noteworthy by its virtual non-existence!

Of all the causes of single-engine IFR accidents, including getting on instruments inadvertently, panic, loss of control, etc., "*pilot error*", the whipping boy of most air-carrier (multi-engine) accidents, seems to be the leader.

Therefore, we must select an airplane whose engine installation has a record of proven reliability under normal, well-maintained circumstances. It should have speed, and that means be able to make good a ground speed average of at least 125 mph if a flight of several hundred miles is intended, and up to 150 mph or more if a longer flight is anticipated. The weather changes fast enough without inviting trouble, and a slower airplane ties up air traffic unreasonably.

The airplane also must have range at the above speeds. Pilots rarely become lost and call for help with hours and hours of fuel on board. It is not good judgment to operate up to the minimum requirements of CAR 60, IFR rules. Leave that for the multi-engine boys and note how few of them stretch it that far. If you have twice as much gas as you need, then headwinds, ATC and other delays are not going to panic you wondering whether you can even make your destination, no less your alternate. And never take off on less than full allowable fuel, regardless of other considerations, for a full IFR flight. Many weather systems easily exceed the best range of single-engine aircraft.

With adequate fuel range, it is rare that an area entirely out of the operating area or route cannot be reached in event of a general deterioration of the weather. Choice of alternates for a single-engine flight can be affected even more by wind than other weather. During the hurricane season some years ago, a *Bonanza,* bucking the tail of a dying hurricane, departed Tallahassee for Tampa with sufficient gas, considering the existing winds and weather, to choose either Miami or New Orleans as an alternate! In high-density areas, the not unusual delays of an hour or more can produce panic in a pilot who has watched his alternates deteriorate while he awaits his approach time.

The airplane should have full gyro instrumentation, direct attitude reading, etc. IFR cross-country without VHF, ADF, ILS will almost invariably require special requests for non-standard routes, contrary holding patterns and approaches against traffic.

There is wide-spread opinion that an emergency/alternate source of instrumentation and radio power is a *must.* Relying solely on engine vacuum, or on generated electric power poses the same pro's and con's as—why single-engine IFR at all? Heated pitot-head and spare battery-powered LF receivers are good safety aids. Conceding that night flight is essenti instrument flight, flares are also a m Carrying this line of approach furt seat-type parachute cushions might be one-time "out" against which it is har argue. (And the manufacturer could extra protection against the major ca of engine failure by providing dual and lubrication systems.)

The pilot and/or owner of a single gine airplane flown for business is the one who can decide whether any one all of the above considerations must met before he undertakes IFR x=7 co try.

The Pilot

Saving discussions of techniques later, it should be plain to any pilot has visited a busy ATC Center or To ridden in the cockpit of an airliner IFR flight, or listened to his radio in vicinity of terminal airports during weather, that the techniques he lear to get his "fog license" will not su for all the conditions he may encou on an IFR cross-country.

Such flights as may involve special complicated area procedures and low proaches are highly inadvisable for lone single-engine pilot who is not home" on solid instruments, in turbul air, in precipitation or other conditi frequently encountered. This can only acquired through many hours of enro IFR flying, preferably under pre-selec conditions and with experienced coachi

The necessary combination of a surp ing amount of "paper-work", continu pin-point navigation and checking, c munications and even just the handl of the airplane can convert a routine flight into a nightmare for the inexp enced pilot starting out alone. Many le this hard way, but many pay too grea price for flunking one of the lessons this "school". Better instrument sch teach advanced IFR techniques and m professional pilots are glad to share th hard-earned knowledge.

When evaluating the factors on wh he will decide to take off, wait or can the pilot should be able to distinguish tween genuine necessity (as for busine to fly IFR and irresponsible indiffere to the accepted hazards of IFR flight.

Pre-Flight Planning

We must assume a considerable amo of advanced experience in cross-cou radio navigation and a good understand of weather. The limitations imposed single-engine operation vary the pre-fli planning techniques proportionately.

Departure from an IFR area, whet low visibility only, low top or solid cl to a VFR area is the most common situations and poses no special proble However, specialized departure procedu and routings and special radio requ ments, as in some congested areas, not unusual. It is not too much trou to query ATC via phone or in person find out these things before filing. Oc sionally certain routes and altitudes not be available because of one-way t fic flow or for military reasons or cause of holding patterns at adja airports.

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CLASSIFIED ADVERTISING

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Single Engine IFR

(Continued from page 62)

course, very attractive to pilots of unpressurized aircraft, especially single-engine. They may not be available for a variety of reasons: high traffic demand, conflict with other airports or flow of traffic. ATC generally takes them as they come; first come, first served. However, it is usually more efficient to reserve the lower altitudes for short-haul flights, other circumstances permitting.

Obviously, a known low top of clouds is ideal and quickly seized upon by pilots, and until recently by ATC. "Five-on-top" may still be requested by the pilot who has *definite* information as to the height of the clouds, but in many sections of the country ATC will no longer assign it as a condition of an IFR clearance.

The pilot must understand that he is actually *VFR-on-top* and is solely responsible for his own separation from other aircraft and cannot go on instruments or descend through without further clearance! Again, ATC is best equipped to advise as to the practicality of this type of IFR plan at any time or in any area.

ATC-imposed deviations from your planned route of flight will drastically affect your flight plan, fuel consumption and time enroute, and so will the possibility of icing or turbulence and enroute or destination delays. Hence, the necessity for increasing the normal tolerances when planning single-engine IFR.

Inasmuch as equipment is necessarily limited by size and weight, plus the limitations of one pilot to fly, navigate and communicate, there is a possibility of receiving ATC instructions that are difficult to comply with.

Weather-wise, it is up to the individual to determine those minimum conditions at take-off, enroute and at destination which he feels able to handle. The published approach minimums for civil aircraft (other than air-carriers) are, of course, the rock-bottom minimums to which he must adhere normally, or be in violation.

No take-off minimums are enforced due to a quirk in the legal authority of the CAA Administrator, and this is a clear invitation to certain types of pilots to engage in suicidal operations. But if tempted to exceed the take-off minimums suggested in the manual, it should be realized that any untoward incident resulting from or associated with such an operation could quickly result in an alleged violation of those parts of CAR relating to *dangerous and reckless operation.*

In certain categories of instrument approach factors, such as visibility, the CAA recognizes the greater maneuverability of aircraft with stall speeds below 75 mph, and permits lower minimums. Although they have not established a "sliding scale" of lower visibility with proportionate increases in reported ceilings (as for the air-carriers), it would seem logical to avoid use of the lowest of both in combination and establish one's own sliding scale.

VFR flight in marginal visibility along an airway or in a congested area, with stations reporting base of clouds lower than the enroute IFR minimums, is an extremely questionable practice. A full on-the-gauges or on-top flight over such conditions is almost as questionable bu unless engine failure occurs, leaving littl choice between the two alternative op erations, at least the "stuffed cloud" haz ard is not constantly present.

Here again a sliding scale of giving away visibility for ceiling, or vice versa would be applicable. In mountainous country, these considerations are going to be more desperate, as they are for the twin engine pilot. No rule of thumb is going to apply where some stations are on high points and others in low valleys. It is not unusual to find low overcasts off the Gul or Atlantic covering the coastal and central plains while the Appalachian valleys and peaks are in the clear. Deep weather systems from other sources, however, will often saturate such areas and obscure all ridges.

Weather in the western mountainous areas has its own characteristics and a few single-engine pilots have developed techniques for a fair number of combinations although the limitations appear to be greater. In any case, a pilot new to such areas might very well refrain from any IFR operation until he has been briefed.

At destination, some successful and experienced business pilots of single-engine aircraft look for *not less than* "circling minimums" with a forecasted improvement when planning IFR flight. This makes the gamble better that, on arrival, the weather won't have dropped to less than "straight-in-minimums" (the lowest). Again, several good alternates at short range with unquestioned VFR is the best insurance.

It is always amazing to note how many pilots neglect to check up in advance on the operational status of facilities (to be used enroute and at destination) on which they are going to be dependent. This is vital for the single-engine boy with his limited equipment.

Not long ago, an experienced business pilot declined to take his boss out of a southern station to New York when the airlines were flying the route and predicting routine arrivals. The boss huffily se out on an airline flight calculated to pu him into New York about the time th single-engine lad estimated take-off, based on the weather trend.

The airline flight holed up in Washington for a couple of hours for ATC delays then took off, waited over New York fo over another hour when weather went be low minimums on arrival; then went to it alternate, Hartford, to cancel out!

Meanwhile, the company pilot took o from the southern city about the time th airliner left Washington, rode the back o the front into New York, arriving withi the hour after it opened, and waited fo his boss to arrive from Hartford thre hours later and after a bus ride.

The single-engine pilot can often fl *around* weather that the airline mus plunge through for route and traffic con siderations. Other non-airline pilots flyin twin-engine equipment may often elect t follow the airline's course because of thei admittedly superior capacity to handl that kind of weather. But that 10 or 15% of weather that should ground even th most experienced and best-equipped singl engine pilot usually also grounds his twin engined counterpart. The best rule commo to both is—when in doubt, *don't!*